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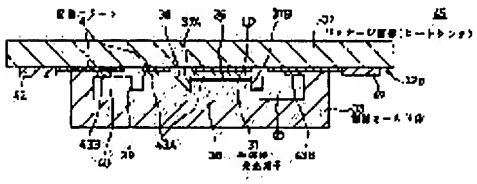
(54) PACKAGE OF SEMICONDUCTOR LIGHT-EMITTING ELEMENT AND ITS MANUFACTURE



(57)Abstract:
PURPOSE: To obtain the package, of a face-type semiconductor light-emitting element, which can dissipate heat from the surface side while light is being emitted to the surface side of the element by a method wherein the semiconductor light-emitting element is pasted so as to correspond to a wiring pattern formed on the light-emitting element side of a package window part.
CONSTITUTION: A package is provided with a plurality of semiconductor light-emitting elements 31 (LDs) which emit light to the upper side with reference to a semiconductor substrate 35 and with a package window part 32 which is composed of a transparent heat sink. A wiring pattern 41 is formed on the light-emitting element side of the package window part 32, and the semiconductor light-emitting elements 31 are pasted so as to correspond to the wiring pattern 41. That is to say, the wiring pattern 41 is formed on the transparent heat sink 32, and the plurality of semiconductor light- emitting elements 31 (LDs) which emit light to the upper side with reference to the semiconductor substrate 35 are pasted on the side of the wiring pattern. Then, the plurality of semiconductor light-emitting elements are sealed with a resin 33 so as to be covered, and the transparent heat sink 32 is divided into a plurality of packages by a dicing operation.

CLAIMS

[Claim(s)]
[Claim 1] The package of the semi-conductor light emitting device characterized by having the semi-conductor light emitting device which emits light to the up side to a semi-conductor substrate, and the package window part which consists of a transparence heat sink, coming to form a circuit pattern in said light emitting device side of said package window part, and for said semi-conductor light emitting device sticking, and changing corresponding to this circuit pattern.
[Claim 2] The package of the semi-conductor light emitting device according to claim 1 characterized by coming to form element components in said package window part.
[Claim 3] The manufacture approach of the package of the semi-conductor light emitting device characterized by to have the process which forms a circuit pattern on a transparence heat sink, the process which sticks two or more semi-conductor light emitting devices which emit light to a semi-conductor substrate at the bottom to the circuit pattern side of said transparence heat sink, the process which covers two or more of said semi-conductor light emitting devices, and closes with resin, and the process which divides said transparence heat sink into two or more packages by dicing, and to use said transparence heat sink as the window part of said package.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the package and its manufacture approach of a semi-conductor light emitting device.
[0002]
[Description of the Prior Art] Generally, fundamentally, using the bottom part or submounting substrate of a package as a heat sink, the packaging of the conventional semi-conductor light emitting device uses a transparent material for a cap and aperture of a package, and the approach of taking out light is used for it. That is, by the old approach, the heat sink and the aperture which takes out light were formed separately.
[0003] Drawing 25 and drawing 26 show the structure of the package which mounted the conventional semi-conductor light emitting device, respectively. The semi-conductor light emitting device package 8 of drawing 25 attaches the cap 4 which carries out the crown-ed of a laser diode 3 and the heat sink 2 on a substrate 1, in order to emit outside the light L outputted to this cap 4 from a laser diode 3, forms the transparence aperture 5 and is constituted, while arranging a heat sink 2 and attaching a laser diode 3 on a substrate 1 at the 1 side of this heat sink 2. The terminal pin prepared by 6 penetrating a substrate 1 and 7 are metal thin lines which

connect between the terminal pins 6 with the electrode of a laser diode 3.
[0004] The semi-conductor light emitting device package 10 of drawing 26 is hybrid mold structure, it arranges a semi-conductor substrate on the base in the package structure 11, arranges the submounting substrate (semi-conductor substrate) 13 and prism 14 on this semi-conductor substrate 12, attaches a laser diode 15 on this submounting substrate 13, attaches the transparence aperture 16 in the top face of the package structure 11, and is constituted. With this semi-conductor light emitting device package 10, it is made as [emit / light / to the method of outside / the light L outputted from a laser diode 15 reflects on the slant face of prism 14, penetrates the transparence aperture 16, and]. Moreover, when constituted as an optical pickup, as the return light reflected by the disk shows with a broken line, incidence is carried out into prism 14, and it is made as [receive / by the photo detector 17 formed in semi-conductor substrate 12 front face, i.e., a photodiode, / light]. With this configuration, the semi-conductor substrate 12 and the submounting substrate 13 act as a heat sink of a laser diode 15.
[0005]
[Problem(s) to be Solved by the Invention] By the way, in the case of a hybrid mold, it can constitute from a conventional approach somehow like the case where the side which takes [a heat sink 2 and] out Light L is not the same like the semi-conductor light emitting device package 8 of drawing 25 , and the semi-conductor light emitting device package 10 of drawing 26 .
[0006] As [need / however, / taking out light to the side front of a component / for a side front / a heat sink] For example, the two-dimensional light emitting device 22 of a monolithic mold, i.e., the laser diode which becomes the semi-conductor substrate 21 from a level resonator as shown in drawing 23 , is formed. Counter one resonator end-face 23A of (however, 20 is shown on behalf of a barrier layer), and the resonator end faces 23A and 23B, for example, the 45-degree reflector 24 is formed. It is hard coming to attach a heat sink in a two-dimensional light emitting device by which it is reflected in a reflector and outgoing radiation of the light L outputted from resonator end-face 23A is carried out perpendicularly.
[0007] In this case, the constraint on the structure of a component or actuation, such as making especially efficient the laser diode 22 which is a light emitting device, using by low-power output comparatively, or using by pulse operation, comes out.
[0008] Although wiring 26 on the side front of a laser diode 22 is thickened and the method of making a role of a heat sink play is also once considered in this thick film wiring 26 using a plating technique etc. as shown in drawing 24 , it is not easy to form a metaled thick film on an irregular component, and heat cannot necessarily acquire namely, transmit sufficient heat sink effectiveness outside easily in many cases.
[0009] For example, it seems that this invention needs a heat sink for a side front, taking out light to the side front of a component, it offers the package and its manufacture approach of the semi-conductor light emitting device which enabled it to conquer the above troubles in the field light emitting device of a monolithic mold.
[0010]
[Means for Solving the Problem] The package of the semi-conductor light emitting device concerning the 1st this invention has the semi-conductor light emitting device 31 (LD) which emits light to the up side to the semi-conductor substrate 35, and the package window part 32 which consists of a transparence heat sink, and is considered as the configuration on which it comes to form a circuit pattern 41 in the light emitting device 31 side of the package window part 32, and the semi-conductor light emitting device 31 was stuck corresponding to the circuit pattern 41.
[0011] The package of the semi-conductor light emitting device concerning the 2nd this invention is considered as the configuration in which the element components 52 and 96, such as an optical element, were formed in the package window part 32 in the 1st invention.

[0012] The manufacture approach of the package of the semi-conductor light emitting device concerning the 3rd this invention The process which forms a circuit pattern 41 on transparence heat sink 32A, and the process which sticks two or more semi-conductor light emitting devices 31 (LD) which emit light to the semi-conductor substrate 35 at the bottom to the circuit pattern 41 side of transparence heat sink 32A, It has the process which covers two or more semi-conductor light emitting devices 31, and is closed with resin 33, and the process which divides transparence heat sink 32A into two or more packages by dicing, and is characterized by using a transparence heat sink as the window part 32 of a package.
[0013]
[Function] In the package of the semi-conductor light emitting device concerning the 1st this invention By having the package window part 32 which serves as the semi-conductor light emitting device 31 which emits light to the semi-conductor substrate 35 up side from a transparence heat sink, and considering as the configuration which stuck the semi-conductor light emitting device 31 corresponding to the circuit pattern 41 of the package window part 32 While outgoing radiation of the light can be carried out to the semi-conductor light emitting device 31 bottom through the package window part 32, the package window part 32 can act as a heat sink, and can radiate heat outside in generation of heat of the semi-conductor light emitting device 31.
[0014] Moreover, since the package window part 32 and the semi-conductor light emitting device 31 are stuck and are constituted, package structure is simplified extremely. Moreover, since a circuit pattern 41 is formed in the package window part 32, it becomes possible to simplify a complicated multilayer-interconnection process and to mount the package of this semi-conductor light emitting device in other component-mounting substrates (for example, wiring substrate) 46 directly, and the handling of mounting of the package of a semi-conductor light emitting device becomes simple.
[0015] In the package of the semi-conductor light emitting device concerning the 2nd this invention, it becomes possible by forming the element components 52 and 96, such as an optical element, in a package window part further to give various functions.
[0016] In the manufacture approach of the package of the semi-conductor light emitting device concerning the 3rd this invention, since two or more of these semi-conductor light emitting devices 31 are closed with resin 33 after forming a circuit pattern on transparence heat sink 32A and sticking two or more semi-conductor light emitting devices 31 on the circuit pattern 41 side of this transparence heat sink 32A, the hermetic seal of the semi-conductor light emitting device 31 is completely carried out to transparence heat sink 32A with resin 33. Subsequently, by carrying out the dicing of the transparence heat sink 32A with resin 33, dividing into two or more packages and using a transparence heat sink as the package window part 32, the package of a semi-conductor light emitting device to take out light from the light emitting device 31 bottom, and use the upper package window part 32 as a heat sink can be manufactured easily, and it is suitable for mass production method.
[0017]
[Example] Hereafter, with reference to a drawing, the package of the semi-conductor light emitting device by this invention and the example of the manufacture approach are explained.
[0018] Drawing 1 A shows one example of the package of the semi-conductor light emitting device concerning this invention, and drawing 1 B shows the condition of having attached the package of this semi-conductor light emitting device in component-mounting substrates (for example, wiring substrate etc.). In this example, it consists of the semi-conductor light emitting device 31, the package window part 32 which consists of a heat sink of a transparent (that is, transmission is high) ingredient to the wavelength of the light L outputted from this semi-conductor light emitting device 31, and the resin mold object 33 which closes the semi-conductor light emitting device 31.

[0019] The laser diode LD with which the semi-conductor light emitting device 31 becomes the whole surface of the semi-conductor substrate 35 from a level resonator is formed. Counter one resonator end-face 37A of (however, 36 shows a barrier layer as a representative), and the resonator end faces 37A and 37B, for example, the 45-degree reflector 38 is formed. It is constituted as a two-dimensional light emitting device by which it is reflected in a reflector 38 and outgoing radiation of the light L outputted from resonator end-face 37A is carried out perpendicularly. 39 is the separation slot formed so that the field containing a laser diode LD and a reflecting mirror might be surrounded, and the periphery section 40 of the separation slot serves as a field for the closures.

[0020] In the case of a required component, its input of the light from the outside must also be transparent also to the input wave Nagamitsu while the package window part 32 which consists of a transparence heat sink is transparent to the light wave length outputted from a laser diode LD. as the ingredient of the package window part 32 which consists of this transparence heat sink -- sapphire, a ruby, beryllia, a diamond, and Si and SiO2 etc. -- what is necessary is just to choose the most suitable ingredient, after being able to use and taking the magnitude of effectiveness, the cost of a package, etc. into consideration as the property of a semi-conductor light emitting device, and a heat sink

[0021] It consists of a plane-parallel plate with a larger area than the resin mold object 33, and a circuit pattern 41 is formed in field 32a in which it is mounted, the field 31, i.e., semi-conductor light emitting device, of one of these, and it connects with a circuit pattern at the part extended outside, and the package window part 32 forms the electrode pad section 42 for signal ejection, and consists of resin mold objects 33. As a circuit pattern 41, it can form with the usual wiring materials, such as aluminum, Au, or transparence wiring material.

[0022] To the package window part 32, the semi-conductor light emitting device 31 is stuck through the solder layer 43 [43A, 43B] by junction down, is put together, and is joined so that the top face by the side of the outgoing radiation of the light L may opposite-** to the circuit pattern 41 of the package window part 32. 43A is the solder for wiring and 43B is the solder for the closures prepared in the field for the closures of a component 31.

[0023] In the condition of having been mounted in the package window part 32 which this semi-conductor light emitting device 31 becomes from a transparence heat sink, mold is carried out by resin from a rear-face side so that the semi-conductor light emitting device 31 may be covered, and the resin mold object 33 is formed.

[0024] The hermetic seal of the whole is carried out and the semi-conductor light emitting device 31 is protected from the exterior by the package window part 32 and the resin mold object 33.

[0025] The semi-conductor light emitting device package 45 of this configuration is mounted in the component-mounting substrate 46 which has a circuit circuit pattern etc. through the electrode pad 42, as shown in drawing 1 B. Since it is the configuration which stuck the package window part 32 which consists of a transparence heat sink on the side front which comes out of and carries out light of the semi-conductor light emitting device 31 which is a two-dimensional light emitting device according to this semi-conductor light emitting device package 45, while being able to make the outgoing radiation of the light from the semi-conductor light emitting device 31 carry out perpendicularly, heat can be radiated good by being directly in contact with this package window part 32.

[0026] Since wiring can be divided and formed on the semiconductor chip with which the semi-conductor light emitting device 31 is formed, and the package window part 32 by forming a circuit pattern 42 in the whole surface of the package window part 32, simplification of a complicated multilayer-interconnection process can be attained.

[0027] Furthermore, compared with the conventional package structure, structure becomes very easy, and manufacture is easy, and is cheap and it is suitable for mass production method.
[0028] Drawing 2 shows the field luminescence laser array 48 which arranged 3x4 surface emission-type laser LD of a reflective mold 45 degrees. The lower wiring layer 49 is formed in a laser array side, other wiring layers (namely, circuit pattern) 41 are formed on the package window part 32 which consists of a transparence heat sink, and it consists of this field luminescence laser array 48. For example, the n mold GaAs layer formed for example, on the half-insulation GaAs substrate can constitute the lower wiring layer 49, and a laser diode array is formed on this n mold GaAs layer. Thus, when this invention is applied to the field luminescence laser array 48, simplification of a complicated multilayer-interconnection process can be attained.
[0029] Regardless of the example of drawing 1 , various deformation is possible for this invention. For example, it may replace with a resin mold object, and a semi-conductor light emitting device may be fixed with adhesives etc., and a whole surface deposit may be carried out by CVD.
[0030] Furthermore, on the package window part 32 which serves as this heat sink if needed, it is possible optical elements, such as a photodetector not only by the circuit pattern 41 but a hologram, the grating, the lens, the reflective film, and amorphous silicon and polycrystalline silicon, and to accumulate element components, such as a component circuit, further. Next, a modification is shown.
[0031] Drawing 3 shows other examples of the package of the semi-conductor light emitting device concerning this invention. In the configuration of drawing 1 , this example is replaced with the resin mold object 33, it fixes and the package window part 32 which consists of a semi-conductor light emitting device 31 and a transparence heat sink consists of resin adhesives 48 so that the circumference of the semi-conductor light emitting device 31 may be enclosed. Since other configurations are the same as that of drawing 1 , they give the same sign to a corresponding part, and omit duplication explanation.
[0032] With the semi-conductor light emitting device package 49 of drawing 3 , since the semi-conductor light emitting device 31 is fixed to the package window part 32 by the resin adhesives 48, structure becomes easy more and manufacture can be made easy.
[0033] In addition, since it is the configuration which stuck the package window part 32 which consists of a transparence heat sink on the side front from which the light of the semi-conductor light emitting device 31 which is a two-dimensional light emitting device is taken out like the example of drawing 1 , the good heat sink effectiveness over the semi-conductor light emitting device 31 is acquired. Moreover, effectiveness, like that simplification of a complicated multilayer-interconnection process is attained and it is suitable for mass production method is acquired.
[0034] Drawing 4 shows other examples of the package of the semi-conductor light emitting device concerning this invention. It is the case where the new optical coupling element 51 which comes to have the photodiode PD which is semiconductor laser LD and the photo detector which are a light emitting device which these people proposed previously as a semi-conductor light emitting device in this example, i.e., a CLC (KONFO cull laser coupler) device, is applied.
[0035] First, the optical coupling element 51 of a CLC device is explained using drawing 17 - drawing 19 . In this drawing, in 51, an optical coupling element and 62 show the irradiated section, and 63 shows a convergence means, i.e., a condensing optical lens.
[0036] It is unified on the common semi-conductor substrate 66, a light-emitting part 64 and a light sensing portion 65 change, and an optical coupling element 51 is the outgoing radiation light LF from a light-emitting part 64. Return light LR which carried out the focusing exposure and was reflected in the irradiated section 62 from this irradiated section 62 It is condensed by the focusing means 63, and it is constituted so that light may

be received by the light sensing portion 65 arranged in the confocal location (a confocal location near [Strictly]) of the focusing means 63. With this configuration, the light from a light-emitting part 64 considers that optical axis as the configuration which passes the path of the same axle mutually behind as the chain line a shows, and is received in a light sensing portion 65, before being reflected in the irradiated section 62.

[0037] As shown in the enlarged drawing of drawing 19 , a light-emitting part 64 consists of semiconductor laser LD (however, 69 that stripe electrode) which has a level resonator, and a reflecting mirror 67, and a light sensing portion 65 is constituted from this optical coupling element 51 by the photodiode (PD).

Semiconductor laser LD is the future outgoing radiation light LF. It is made in agreement with the path which is reflected with a reflecting mirror 67 and goes to the irradiated section 62.

[0038] and return light LR which goes to a light sensing portion 65 It is what is converged to near the optical diffraction limitation (namely, diffraction limitation of a lens). When, as for a light sensing portion 65, some [that / at least] light-receiving sides set numerical aperture of lambda and the convergence means 63 to NA for the wavelength of the outgoing radiation light from a light-emitting part 64 in this optical diffraction limitation, The distance from the optical axis a of the outgoing radiation light from the light-emitting part 64 which crosses the arrangement datum level S of a light-receiving side is prepared in the location of less than 1.22 lambda/NA.

[0039] Moreover, as shown in drawing 18 and drawing 20 in this case, it is the outgoing radiation light LF of the light-emitting part 64 in the arrangement datum level S of the light-receiving side of a light sensing portion 65. Diameter phis Considering as smallness from diameter phid of the above-mentioned optical diffraction limitation, the effective light-receiving side of a light sensing portion 65 is diameter phis of luminescence. It is made to be located outside. Here, if semiconductor laser is used as the light source of a light sensing portion 64, it is diameter phis of the outgoing radiation light. It is about about 1-2 micrometers. On the other hand, when the numerical aperture NA of the convergence means 63 is [the wavelength lambda of 0.09 to 0.1 and outgoing radiation light] about 780nm about an optical coupling element 51 side, it is a diffraction limitation, i.e., phid. It becomes about 1.22 lambda/NA **10micrometer.

[0040] And a light-emitting part 64 is arranged in the focal location of 1 of the convergence means 63, and the irradiated section 62 is arranged in a confocal location. It is reflected in an outline perpendicular direction with a reflecting mirror 67, and the laser beam by which outgoing radiation was carried out from semiconductor laser LD of a light-emitting part 64 is irradiated by the irradiated section (for example, optical disk) 62 through the convergence means 63. The return light LR reflected from the irradiated section 62 at the time of a focus, i.e., return light reflected including the recording information in the irradiated section 62, It returns, and is again condensed by the convergence means 63, incidence of the same optical path is carried out to the photodiode of the light sensing portion 65 arranged near the confocal location, and it is this return light LR. Light-receiving detection comes to be carried out by the light sensing portion 65. That is, it is changed into an electrical signal and taken out as a signal (for example, regenerative signal).

[0041] The example of representation of the manufacture approach of an optical coupling element 51 is explained here using drawing 21 and drawing 22 . This example is the case where it manufactures by alternative MOCVD. As shown in drawing 21 A, each semi-conductor layer which constitutes semiconductor laser on the substrate 66 which consists of a GaAs substrate which makes a principal plane the crystal face (100) of the 1st conductivity type, for example, n mold, is grown epitaxially. That is, the laminating semi-conductor layer which carried out epitaxy of the 2nd cladding layer 73 which consists of AlGaAs of the 2nd different conductivity type, for example, p mold, from the 1st cladding layer 71 72 which consists of AlGaAs of a substrate 6 and this conductivity type one by one, for example, for example, the barrier layer which consists of GaAs, and the 1st cladding layer 71 by MOCVD etc. one by one is constituted.

[0042] Next, as shown in drawing 21 B, the part which leaves a part of semi-conductor layers 73, 72, and 71 which these-grew epitaxially as semiconductor laser LD, and finally forms a reflecting mirror at least is etched by RIE (reactive ion etching) etc. And the both-ends side of the semi-conductor layer by this etching side is made into the resonator end faces 55A and 55B, respectively, and the level resonator of semiconductor laser LD is constituted between both-ends side 55A and 55B. In this case, although not illustrated, a current inhibition field is formed by the ion implantation of an impurity so that it may face across the field which finally constitutes the resonator of semiconductor laser LD.

[0043] Subsequently, as shown in drawing 21 C, covering formation of the insulating layers, such as the mask layer 74 2 of alternative MOCVD, for example, SiO, and SiN, is carried out so that the configuration section of the laminating semi-conductor layer left behind on the substrate 66, i.e., semiconductor laser LD, may be covered.

[0044] Next, as shown in drawing 22 D, the 1st semi-conductor layer 75 by GaAs of the 1st conductivity type, for example, n mold, is alternatively formed by MOCVD on the substrate 66 which is not covered with the mask layer 74.

[0045] Then, as shown in drawing 22 E, the 2nd semi-conductor layer 76 by GaAs of the 2nd conductivity type, for example, p mold, is alternatively formed by MOCVD, and Photodiode PD is formed by the 1st and 2nd semi-conductor layers 75 and 76.

[0046] Next, as shown in drawing 22 F, etching removal of the mask layer 74 is carried out, the electrodes 77 and 78 of one way each of semiconductor laser LD and Photodiode PD are put on OMIKKU, respectively, and the electrode 79 common to the rear face of a substrate 66 is put on the part on semiconductor laser LD and the 2nd semi-conductor layer 76 at OMIKKU.

[0047] In this case, it becomes the semi-conductor layer by which epitaxial growth was alternatively carried out on the substrate 66 of drawing 22 D, and the crystal face as which resonator end-face 55A of the 1st semi-conductor layer 75 and the field 80 which counters were specified in this example. For example, the direction of cavity length of the level resonator of the semiconductor laser formed between end-face 55A of semiconductor laser, and 55B, That is, among drawing 22 F, when it is generated as a slant face according [an opposed face 80] to {111} A when making into [011] crystal orientations the direction shown by the arrow head b and Direction b is made into [0-11] crystal orientation, it is generated as a slant face by {111} B, and in all, the angle with the plate surface of a substrate 66 to make becomes 54.7 degrees. Moreover, when making Direction b into [100] crystal orientations, it is generated as {110} and an opposed face 80 makes 45 degrees to the field of a substrate 66. All are formed as a slant face 80 with the sufficient morphology by the atomic plane.

[0048] Therefore, about the slant face 80 by the specified crystal face which was formed by doing in this way, as shown in drawing 22 F, it is the outgoing radiation light LF from end-face 55A of the level resonator of semiconductor laser LD. It can consider as the reflecting mirror 67 which is made to reflect and is turned in the predetermined direction. According to this configuration, since a reflecting mirror 67 is formed of the crystal face, it excels in mirror plane nature, and a setup of that inclination is performed correctly.

[0049] A deer is carried out, and in this example, as shown in drawing 4 A, it consists of the optical coupling element 51 as a semi-conductor light emitting device mentioned above, the package window part 32 which consists of a heat sink of a transparent ingredient to the wavelength of the light (and return light) L outputted from semiconductor laser LD of this optical coupling element 51, and the resin mold object 33 which closes an optical coupling element 51. The same ingredient as above-mentioned drawing 1 can be used for the ingredient which constitutes the package window part 32.

[0050] At this example, the predetermined electrode pattern 41 is especially formed in the component side of

the optical coupling element 51 of the package window part 32, and while forming so that an opposite side, i.e., the side front side of the package window part 32, may be faced that electrode pad 42 with a component side, a hologram 52 is made from optical elements, such as a hologram and a grating, and this example to this package window part 32.

[0051] And through the solder layer 43 [43A, 43B], it sticks on the package window part 32 by the so-called junction down, and fixes so that the field by the side of this optical coupling element 51, i.e., semiconductor laser LD of that level resonator, may be opposite-**(ed) to the circuit pattern 41 of the package window part 32, and the resin mold object 33 is formed from the rear-face side of an optical coupling element 51, and the semi-conductor light emitting device package 54 is constituted. A hologram 52 is formed so that it may correspond to the location where the light from semiconductor laser LD penetrates the package window part 32.

[0052] It is prepared in the confocal location at which the zero-order light of the return light which passed the hologram 52, for example arrives as a light sensing portion, and each location at which for example, +primary light and -primary light arrive. As shown in drawing 4 B, this semi-conductor light emitting device package 54 is mounted through the electrode pad 42 so that the side front of the package window part 32 may serve as facing down to the component-mounting substrate 46.

[0053] In the semi-conductor light emitting device package 54 of this configuration, much more functions can be given by making optical elements, such as a hologram 52 and a grating, to the package window part 32 which serves as a heat sink. In addition, the same operation effectiveness is done so with the example of drawing 1 having explained.

[0054] Next, an example of the manufacture approach of the above-mentioned semi-conductor optical element package 54 is explained using drawing 5 and drawing 6 .

[0055] First, as shown in drawing 5 A, transparence substrate 32A used as the package window part 32 of heat sink combination is prepared, and the through hole 57 for forming an electrode pad for every field section used as each package window part is formed.

[0056] next, as shown in drawing 5 B, the predetermined circuit pattern 41 is formed, respectively on whole surface 32a corresponding to each field section of transparence substrate 32A, and it connects with this circuit pattern 41 -- as -- a through hole 57 -- letting it pass -- transparence substrate 32A -- the electrode pad 42 is formed so that the 32b side may be attended on the other hand. Furthermore, the solder layer 43 [43A, 43B] is formed on a circuit pattern 41.

[0057] next, it is shown in drawing 5 C -- as -- transparence substrate 32A -- on the other hand, a hologram 52 is formed in the predetermined location of 32b.

[0058] Next, as shown in drawing 6 D, an optical coupling element 51 is stuck on the circuit pattern 41 side of transparence substrate 32A by junction down, and it fixes. An optical coupling element 51 is joined to a circuit pattern 41 by junction down. The substrate side of an optical element 51 is also connectable with other circuit patterns 41 by wire bonding.

[0059] Next, as shown in drawing 6 E, whole surface resin mold is carried out so that each optical coupling element 51 may be covered, and the resin mold object 33 is formed.

[0060] As shown in drawing 6 F after an appropriate time, dicing processing is performed, it divides into two or more packages, and the semi-conductor light emitting device package 54 to come to cover an optical coupling element 51 with lamination and a resin mold object to the package window part 32 of the transparence heat sink with which the hologram 52 was formed in the optical coupling element 51 is obtained.

[0061] According to this manufacture approach, a production process is compacted extremely, and the semi-conductor light emitting device package 54 is easy structure, and it is miniaturized extremely. Therefore, it is

fit for mass production method, and becomes advantageous to reduction-izing of a manufacturing cost, the miniaturization of a product, etc.

[0062] Drawing 7 and drawing 8 show other examples of the manufacture approach using a leadframe. As shown in drawing 7 A, transparence substrate 32A used as the package window part 32 of heat sink combination is prepared, a predetermined circuit pattern 41 and the predetermined electrode pad 42 are formed, respectively on whole surface 32a of the field section used as each package window part, and the solder layer 43 [43A, 43B] is formed on a circuit pattern 41.

[0063] next, it is shown in drawing 7 B -- as -- each field section of transparence substrate 32A -- on the other hand, a hologram 52 is formed in the predetermined location of 32b.

[0064] Next, as shown in drawing 7 C, an optical coupling element 51 is stuck on the circuit pattern 41 side of transparence substrate 32A by junction down, and it fixes.

[0065] Next, as shown in drawing 8 D, dicing divides transparence substrate 32A so that each optical coupling element 51 may be separated.

[0066] The package window part 32 in the condition that each optical coupling element 51 was fixed is joined to a leadframe 58 through the electrode pad 42 the appropriate back, subsequently resin mold is given, and the resin mold object 33 is formed. Thus, the semi-conductor light emitting device package 59 made into the purpose of the form which drew the lead is obtained.

[0067] According to this manufacture approach, the semi-conductor light emitting device package 59 suitable for mounting which needed the lead section can manufacture easily.

[0068] Drawing 9 shows other examples of the package of the semi-conductor light emitting device concerning this invention.

[0069] The package window part 92 by ingredients, such as the transparent material whose heat conductivity is not not much high as a package window part, for example, plastics etc., is used for this example. The metal thickness film heat sink 93 which serves as a circuit pattern on the whole surface of this package window part 92 using plating etc. is formed. In this example, it is formed so that the front face of the package window part 92 may be faced the electrode pad 42 linked to the thick-film heat sink 93. And lamination and the resin mold object 33 are formed in the circuit pattern 93 of this thick-film heat sink for an optical coupling element 51 through the solder layer 43 [43A, 43B], and the semi-conductor light emitting device package 94 is constituted.

[0070] Since the circuit pattern 93 which serves as a thick-film heat sink to the plate-like package window part 92 is formed according to the semi-conductor light emitting device package 94 of this configuration, it can constitute easily rather than it forms in the light emitting device which is irregular like the example shown in drawing 24 directly. Moreover, since the transparent materials (for example, plastics etc.) which are not high as for the heat conductivity can be used as a package window part 92, the advantageous semi-conductor light emitting device package in cost can be constituted.

[0071] Drawing 10 shows other examples of the package of the semi-conductor light emitting device concerning this invention. The semi-conductor light emitting device package 97 of this example consists of a package window part 32 which consists of a transparence heat sink, and an optical coupling element 51 and the resin mold object 33, and an optical element 52, i.e., a hologram, and a grating 96 are made to both sides of the package window part 32, and it constitutes them to them. According to an application, the usual lens, a Fresnel lens, prism, etc. are made to the package window part 32, and can also be multi-functionalized to it. Since other configurations are the same as that of drawing 4 , the same sign is given to a corresponding part and duplication explanation is omitted.

[0072] Drawing 11 shows other examples of the package of the semi-conductor light emitting device

concerning this invention. As an optical element is not made to the package window part 32 which consists of a transparence heat sink and it is shown in drawing 10 , the semi-conductor light emitting device package 99 of this example forms an optical element 52, for example, a hologram, and a grating 96 in both sides of another transparence plate 101, is stuck on a front face opposite to the field where this transparence plate 101 was stuck on the optical coupling element 51 of the package window part 32, and constitutes them. Since other configurations are the same as that of drawing 1 A, they give the same sign to a corresponding part, and omit duplication explanation.

[0073] According to the semi-conductor light emitting device package 99 of this configuration, although components mark increase by addition of another transparence plate 101, since the hologram 52 of an optical element and the alignment of a grating 96 can carry out after mounting of a light emitting device or a photo detector (i.e., this example) after mounting to the package window part 32 of an optical coupling element 51, it is convenient for what needs the alignment of a high precision, and becomes advantageous to the yield etc. Moreover, ** will become possible, if the usual lens, a Fresnel lens, prism, etc. are made to another transparence plate 101 and multi-functionalized to it according to an application.

[0074] Drawing 12 shows other examples of the package of the semi-conductor light emitting device concerning this invention. The semi-conductor light emitting device package 103 of this example is not a laser side, and makes to the package window part 32 side, the photo detector PD, i.e., the photodiode, of an optical coupling element 51 which is a CLC device.

[0075] That is, the photodiode PD by the amorphous silicon by plasma CVD or polycrystalline silicon is formed in the location corresponding to semiconductor laser LD and a reflector 67, and the wiring 104 of Photodiode PD is formed at the whole surface of the package window part 32 which consists of a transparence heat sink. 105 is an insulator layer for protecting Photodiode PD. The necessary circuit pattern 41 for a chip is formed including this insulator layer 105. the package window part 32 -- on the other hand -- being alike -- an optical element 52, for example, a hologram, is formed. And the resin mold object 33 is formed in the package window part 32 from the rear face of lamination and an optical coupling element 51, and the semi-conductor light emitting device package 103 is constituted so that an optical coupling element 51 may be connected to a circuit pattern 41 through the solder layer 43 [43A, 43B].

[0076] In an optical coupling element 51, in case the photodiode PD which is a photo detector is made to a laser side, although it is easy to make on a reflector 67, on Laser LD, it is difficult to take independently and it cannot make the electrode of Laser LD and Photodiode PD easily. However, according to the semi-conductor light emitting device package 103 of drawing 11 , since Photodiode PD is formed on the package window part 32, the above-mentioned problem can be solved and light-receiving effectiveness can be gathered.

[0077] Drawing 13 shows other examples of the package of the semi-conductor light emitting device concerning this invention. The semi-conductor light emitting device package 107 of this example is set in the semi-conductor light emitting device package 103 of drawing 12 . The include angle alpha of the reflector 67 of an optical coupling element 51 is made into a larger include angle than 45 degrees. Outgoing radiation light LF The photodiode PDc (for example, for laser output monitors) by the side of the laser LD of the photodiode PD [PDa, PDb, and PDc] which reflected the part on the front face of the package window part 32, and was formed in the package window part 32 is made to receive light. return light LR it reflects within the package window part 32 -- making -- the photodiode PDa the object for the focus servo signal detection by the side of a reflector 67, or for truck servo signal detection, and PDb It constitutes so that light may be received. Although drawing 13 shows only the important section, since it is the same as that of drawing 12 , other configurations are omitted.

[0078] In addition, although considered as the configuration in which the inside of the package window part

32 was reflected in this example, another transparence plate can be arranged on the package window part 32, and this transparence plate can also be used for reflection.

[0079] Drawing 14 shows other examples of the package of the semi-conductor light emitting device concerning this invention. The semi-conductor light emitting device package 109 of this example accumulates the optical coupling element 51 and IC110 for an operation of a CLC device by the hybrid on the package window part 32 which consists of a transparence heat sink, and the whole surface mold of it is carried out, and it forms and constitutes the resin mold object 33 from a tooth back. In addition, the same sign is given to drawing 4 and a corresponding part, and duplication explanation is omitted.

[0080] Since the whole surface is covered for a tooth back with the resin mold object 33 with this configuration, IC110 for an operation can be shut up completely optically, and there are also no problems, such as malfunction by the stray light from an optical coupling element 51.

[0081] Also in each semi-conductor light emitting device packages 94, 97, and 99,103,107,109 mentioned above, the same operation effectiveness is done so with the example of drawing 1 having explained. Each example of the semi-conductor light emitting device package using the optical coupling element 51 of a CLC device is applicable to the optical pickup of optical disk drives, such as the so-called compact disk (CD) player and a magneto-optic-disk player.

[0082] On the other hand, this invention is advantageous also to the application to perpendicular resonator side luminescence laser.

[0083] Drawing 15 shows other examples of the package of the semi-conductor light emitting device concerning this invention applied to perpendicular resonator side luminescence laser. In this example, the 1st reflective film (n mold) 113 which consists of semi-conductor multilayers and dielectric multilayers of high reflection is formed, for example on n mold substrate 112. While forming the 1st cladding layer 114, a barrier layer 115, the 2nd cladding layer 116 and the 1st reflective film 113, and the 2nd same reflective film (p mold) 117 on this reflective film 113 The outgoing radiation side side of the perpendicular resonator side luminescence laser 120 which forms the current block layer 118 in both sides, forms the cap layer 119 further, and carries out field generating perpendicularly by the current impregnation A Lamination and a tooth back are covered with the resin mold object 33 through the solder layer 43 to the field where the circuit pattern 41 was formed in the package window part 32 which consists of a transparence heat sink, and the semi-conductor light emitting device package 121 is constituted.

[0084] Also in this configuration, while the package window part 32 is penetrated and light carries out outgoing radiation, this package window part 32 serves as a heat sink, and makes good heat dissipation of a surface emission-type laser.

[0085] Generally, since perpendicular resonator side luminescence laser has semi-conductor multilayers and dielectric multilayers of high reflection, it is hard to carry out current impregnation A, and resistance between components becomes high. Therefore, generation of heat is large and has big effect on the effectiveness and the engine performance of a component.

[0086] Drawing 16 shows the example of further others of the package of the semi-conductor light emitting device concerning this invention applied to perpendicular resonator side luminescence laser. The semi-conductor light emitting device package 122 of this example forms in the package window part 32 side the 2nd reflective film 117 of the front-side which carries out outgoing radiation of the light, and constitutes it. Other configurations are the same as drawing 15 , give the same sign to a corresponding part, and omit duplication explanation.

[0087] With this configuration, although it is hard coming to make, if micro cavity structure is laser with a comparatively longer resonator, it is using as reflective film by the side of p, and can reduce the problem of

current impregnation considerably.
[0088] The actual process and the structure of the semi-conductor light emitting device package 103 are explained more to a detail using drawing 12 and drawing 17 . As drawing 17 A (sectional view) and drawing 17 B (top view) show the optical coupling element 51 which is a CLC device, semiconductor laser LD of the level resonator with which the stripe electrode 132 was formed in the center on a semi-conductor substrate is formed, resonator end-face 55A of one of these is countered, and a reflector 67 is formed. The separation slot 39 is minded [which counters resonator end-face 55B of another side], and it is the photodiode PD 2 for monitors. It is formed. photodiode PD 3 for tracking servos in the field top by the side of a reflector 67 Photodiodes [PD / PD and / 5] 4 for focus servos with a metal grid to the both sides which sandwich this it forms -- having -- each photodiodes [PD / PD, PD /3 /, and / 4] 2 and PD5 from -- the polar zone 130 for contact is formed. The metal layer 131 for seals is formed in the periphery enclosure on a substrate 66.
[0089] The external electrode (namely, electrode pad) of a package 103 can use properly the form which used the through hole, and the form of only one side by the application. It is formed with aluminum etc. and an external electrode (namely, electrode pad) and internal wiring (namely, circuit pattern) are a front face SiO2 Or/and, it is protected by SiN etc. The metal layer 131 for seals, and each photodiodes [PD / PD, PD /3 /, and / 4] 2 and PD5 Patterning of solder 43 or the Au electrode is carried out, and the part equivalent to the polar zone 130 for contact is connected with the circuit patterns 41, such as aluminum.
[0090] In the mounting process to the package window part 32 of an optical coupling element 51, since it is easy to carry out a microscope monitor optically from the bottom by drawing 11 when using patterning of solder, very precise location precision **** becomes possible.
[0091] although mounting of an optical coupling element 51 is an individual process -- the one package window part 32 (namely, silicon on sapphire with a diameter of 3 inches) top -- many optical coupling elements 51 -- mounting -- solder -- since it can carry out by bundling up like a heat process and becomes the so-called batch process, a routing counter can be reduced. Moreover, it is also possible to perform adhesion of Au layer and Au layer ultrasonically besides solder.
[0092] In connection of both sides, an optical coupling element 51 turns into a component which was very excellent in the field of temperature-proof and dependability according to the metal structure for seals by carrying out the closure of the whole by the metal layer for seals, the semi-conductor substrate, and the package window part.
[0093] Rather than the resistance to environment of an optical coupling element, whole surface mold is the purpose which prevents a GaAs substrate being exposed, therefore has some spreading means. For example, the coarse DIP process of texture is also enough as an epoxy heat-curing type, (ultraviolet-rays UV) hardening mold resin, etc. which carried out spin coating.
[0094] In dicing, the so-called full cutting process in silicon is performed, and the whole wafer thickness is cut off by the dicer. Therefore, this optical coupling element by which packaging was carried out can be handled with the same feeling as the usual semi-conductor pellet, and its PD top is also simple. That is, automatic mounting to a substrate becomes possible easily like the chip on a pressure sensitive adhesive sheet.
[0095]
[Effect of the Invention] Taking out light to the side front of a two-dimensional light emitting device, the package window part allotted to the side front can act as a heat sink, and generation of heat of a two-dimensional light emitting device can be made to radiate heat effectively according to the semi-conductor light emitting device package concerning the 1st this invention.
[0096] Since the circuit pattern is formed in a package window part, wiring can be divided and formed on the package window part of a chip top and a heat sink, and simplification of a complicated multilayer-

interconnection process can be attained.
[0097] Furthermore, since package structure is simplified compared with the former, manufacture becomes easy and it can provide cheaply.
[0098] According to the semi-conductor light emitting device package concerning the 2nd this invention, since element components, such as a hologram, a grating, a lens, reflective film, a photodetector, and an electronic circuitry, are formed in a package window part, multi-functionalization can be further attained as a package.
[0099] According to the manufacture approach of the semi-conductor light emitting device package concerning the 3rd this invention, the package of the two-dimensional light emitting device which needs a heat sink for a side front can be manufactured with a simply and sufficient precision, taking out light to the side front of a semi-conductor light emitting device.

TECHNICAL FIELD

[Industrial Application] This invention relates to the package and its manufacture approach of a semi-conductor light emitting device.

PRIOR ART

[Description of the Prior Art] Generally, fundamentally, using the bottom part or submounting substrate of a package as a heat sink, the packaging of the conventional semi-conductor light emitting device uses a transparent material for a cap and aperture of a package, and the approach of taking out light is used for it. That is, by the old approach, the heat sink and the aperture which takes out light were formed separately.
[0003] Drawing 25 and drawing 26 show the structure of the package which mounted the conventional semi-conductor light emitting device, respectively. The semi-conductor light emitting device package 8 of drawing 25 attaches the cap 4 which carries out the crown-ed of a laser diode 3 and the heat sink 2 on a substrate 1, in order to emit outside the light L outputted to this cap 4 from a laser diode 3, forms the transparence aperture 5 and is constituted, while arranging a heat sink 2 and attaching a laser diode 3 on a substrate 1 at the 1 side of this heat sink 2. The terminal pin prepared by 6 penetrating a substrate 1 and 7 are metal thin lines which connect between the terminal pins 6 with the electrode of a laser diode 3.
[0004] The semi-conductor light emitting device package 10 of drawing 26 is hybrid mold structure, it arranges a semi-conductor substrate on the base in the package structure 11, arranges the submounting substrate (semi-conductor substrate) 13 and prism 14 on this semi-conductor substrate 12, attaches a laser diode 15 on this submounting substrate 13, attaches the transparence aperture 16 in the top face of the package structure 11, and is constituted. With this semi-conductor light emitting device package 10, it is made as [emit / light / to the method of outside / the light L outputted from a laser diode 15 reflects on the slant face of prism 14, penetrates the transparence aperture 16, and]. Moreover, when constituted as an optical pickup, as the return light reflected by the disk shows with a broken line, incidence is carried out into prism 14, and it is made as [receive / by the photo detector 17 formed in semi-conductor substrate 12 front face, i.e., a photodiode, / light]. With this configuration, the semi-conductor substrate 12 and the submounting substrate 13 act as a heat sink of a laser diode 15.

EFFECT OF THE INVENTION

[Effect of the Invention] Taking out light to the side front of a two-dimensional light emitting device, the package window part allotted to the side front can act as a heat sink, and generation of heat of a two-dimensional light emitting device can be made to radiate heat effectively according to the semi-conductor light emitting device package concerning the 1st this invention.

[0096] Since the circuit pattern is formed in a package window part, wiring can be divided and formed on the package window part of a chip top and a heat sink, and simplification of a complicated multilayer-interconnection process can be attained.

[0097] Furthermore, since package structure is simplified compared with the former, manufacture becomes easy and it can provide cheaply.

[0098] According to the semi-conductor light emitting device package concerning the 2nd this invention, since element components, such as a hologram, a grating, a lens, reflective film, a photodetector, and an electronic circuitry, are formed in a package window part, multi-functionalization can be further attained as a package.

[0099] According to the manufacture approach of the semi-conductor light emitting device package concerning the 3rd this invention, the package of the two-dimensional light emitting device which needs a heat sink for a side front can be manufactured with a simply and sufficient precision, taking out light to the side front of a semi-conductor light emitting device.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, in the case of a hybrid mold, it can constitute from a conventional approach somehow like the case where the side which takes [a heat sink 2 and] out Light L is not the same like the semi-conductor light emitting device package 8 of drawing 25 , and the semi-conductor light emitting device package 10 of drawing 26 .

[0006] As [need / however, / taking out light to the side front of a component / for a side front / a heat sink] For example, the two-dimensional light emitting device 22 of a monolithic mold, i.e., the laser diode which becomes the semi-conductor substrate 21 from a level resonator as shown in drawing 23 , is formed. Counter one resonator end-face 23A of (however, 20 is shown on behalf of a barrier layer), and the resonator end faces 23A and 23B, for example, the 45-degree reflector 24 is formed. It is hard coming to attach a heat sink in a two-dimensional light emitting device by which it is reflected in a reflector and outgoing radiation of the light L outputted from resonator end-face 23A is carried out perpendicularly.

[0007] In this case, the constraint on the structure of a component or actuation, such as making especially efficient the laser diode 22 which is a light emitting device, using by low-power output comparatively, or using by pulse operation, comes out.

[0008] Although wiring 26 on the side front of a laser diode 22 is thickened and the method of making a role of a heat sink play is also once considered in this thick film wiring 26 using a plating technique etc. as shown in drawing 24 , it is not easy to form a metaled thick film on an irregular component, and heat cannot

necessarily acquire namely, transmit sufficient heat sink effectiveness outside easily in many cases.
[0009] For example, it seems that this invention needs a heat sink for a side front, taking out light to the side front of a component, it offers the package and its manufacture approach of the semi-conductor light emitting device which enabled it to conquer the above troubles in the field light emitting device of a monolithic mold.

MEANS

[Means for Solving the Problem] The package of the semi-conductor light emitting device concerning the 1st this invention has the semi-conductor light emitting device 31 (LD) which emits light to the up side to the semi-conductor substrate 35, and the package window part 32 which consists of a transparence heat sink, and is considered as the configuration on which it comes to form a circuit pattern 41 in the light emitting device 31 side of the package window part 32, and the semi-conductor light emitting device 31 was stuck corresponding to the circuit pattern 41.
[0011] The package of the semi-conductor light emitting device concerning the 2nd this invention is considered as the configuration in which the element components 52 and 96, such as an optical element, were formed in the package window part 32 in the 1st invention.
[0012] The manufacture approach of the package of the semi-conductor light emitting device concerning the 3rd this invention The process which forms a circuit pattern 41 on transparence heat sink 32A, and the process which sticks two or more semi-conductor light emitting devices 31 (LD) which emit light to the semi-conductor substrate 35 at the bottom to the circuit pattern 41 side of transparence heat sink 32A, It has the process which covers two or more semi-conductor light emitting devices 31, and is closed with resin 33, and the process which divides transparence heat sink 32A into two or more packages by dicing, and is characterized by using a transparence heat sink as the window part 32 of a package.

OPERATION

[Function] In the package of the semi-conductor light emitting device concerning the 1st this invention By having the package window part 32 which serves as the semi-conductor light emitting device 31 which emits light to the semi-conductor substrate 35 up side from a transparence heat sink, and considering as the configuration which stuck the semi-conductor light emitting device 31 corresponding to the circuit pattern 41 of the package window part 32 While outgoing radiation of the light can be carried out to the semi-conductor light emitting device 31 bottom through the package window part 32, the package window part 32 can act as a heat sink, and can radiate heat outside in generation of heat of the semi-conductor light emitting device 31.
[0014] Moreover, since the package window part 32 and the semi-conductor light emitting device 31 are stuck and are constituted, package structure is simplified extremely. Moreover, since a circuit pattern 41 is formed in the package window part 32, it becomes possible to simplify a complicated multilayer-interconnection process and to mount the package of this semi-conductor light emitting device in other component-mounting substrates (for example, wiring substrate) 46 directly, and the handling of mounting of the package of a semi-conductor light emitting device becomes simple.
[0015] In the package of the semi-conductor light emitting device concerning the 2nd this invention, it

becomes possible by forming the element components 52 and 96, such as an optical element, in a package window part further to give various functions.

[0016] In the manufacture approach of the package of the semi-conductor light emitting device concerning the 3rd this invention, since two or more of these semi-conductor light emitting devices 31 are closed with resin 33 after forming a circuit pattern on transparence heat sink 32A and sticking two or more semi-conductor light emitting devices 31 on the circuit pattern 41 side of this transparence heat sink 32A, the hermetic seal of the semi-conductor light emitting device 31 is completely carried out to transparence heat sink 32A with resin 33. Subsequently, by carrying out the dicing of the transparence heat sink 32A with resin 33, dividing into two or more packages and using a transparence heat sink as the package window part 32, the package of a semi-conductor light emitting device to take out light from the light emitting device 31 bottom, and use the upper package window part 32 as a heat sink can be manufactured easily, and it is suitable for mass production method.

EXAMPLE

[Example] Hereafter, with reference to a drawing, the package of the semi-conductor light emitting device by this invention and the example of the manufacture approach are explained.

[0018] Drawing 1 A shows one example of the package of the semi-conductor light emitting device concerning this invention, and drawing 1 B shows the condition of having attached the package of this semi-conductor light emitting device in component-mounting substrates (for example, wiring substrate etc.). In this example, it consists of the semi-conductor light emitting device 31, the package window part 32 which consists of a heat sink of a transparent (that is, transmission is high) ingredient to the wavelength of the light L outputted from this semi-conductor light emitting device 31, and the resin mold object 33 which closes the semi-conductor light emitting device 31.

[0019] The laser diode LD with which the semi-conductor light emitting device 31 becomes the whole surface of the semi-conductor substrate 35 from a level resonator is formed. Counter one resonator end-face 37A of (however, 36 shows a barrier layer as a representative), and the resonator end faces 37A and 37B, for example, the 45-degree reflector 38 is formed. It is constituted as a two-dimensional light emitting device by which it is reflected in a reflector 38 and outgoing radiation of the light L outputted from resonator end-face 37A is carried out perpendicularly. 39 is the separation slot formed so that the field containing a laser diode LD and a reflecting mirror might be surrounded, and the periphery section 40 of the separation slot serves as a field for the closures.

[0020] In the case of a required component, its input of the light from the outside must also be transparent also to the input wave Nagamitsu while the package window part 32 which consists of a transparence heat sink is transparent to the light wave length outputted from a laser diode LD. as the ingredient of the package window part 32 which consists of this transparence heat sink -- sapphire, a ruby, beryllia, a diamond, and Si and SiO2 etc. -- what is necessary is just to choose the most suitable ingredient, after being able to use and taking the magnitude of effectiveness, the cost of a package, etc. into consideration as the property of a semi-conductor light emitting device, and a heat sink

[0021] It consists of a plane-parallel plate with a larger area than the resin mold object 33, and a circuit pattern 41 is formed in field 32a in which it is mounted, the field 31, i.e., semi-conductor light emitting device, of one of these, and it connects with a circuit pattern at the part extended outside, and the package window part 32 forms the electrode pad section 42 for signal ejection, and consists of resin mold objects 33. As a circuit pattern 41, it can form with the usual wiring materials, such as aluminum, Au, or transparence wiring material.

[0022] To the package window part 32, the semi-conductor light emitting device 31 is stuck through the solder layer 43 [43A, 43B] by junction down, is put together, and is joined so that the top face by the side of the outgoing radiation of the light L may opposite-** to the circuit pattern 41 of the package window part 32. 43A is the solder for wiring and 43B is the solder for the closures prepared in the field for the closures of a component 31.

[0023] In the condition of having been mounted in the package window part 32 which this semi-conductor light emitting device 31 becomes from a transparence heat sink, mold is carried out by resin from a rear-face side so that the semi-conductor light emitting device 31 may be covered, and the resin mold object 33 is formed.

[0024] The hermetic seal of the whole is carried out and the semi-conductor light emitting device 31 is protected from the exterior by the package window part 32 and the resin mold object 33.

[0025] The semi-conductor light emitting device package 45 of this configuration is mounted in the component-mounting substrate 46 which has a circuit circuit pattern etc. through the electrode pad 42, as shown in drawing 1 B. Since it is the configuration which stuck the package window part 32 which consists of a transparence heat sink on the side front which comes out of and carries out light of the semi-conductor light emitting device 31 which is a two-dimensional light emitting device according to this semi-conductor light emitting device package 45, while being able to make the outgoing radiation of the light from the semi-conductor light emitting device 31 carry out perpendicularly, heat can be radiated good by being directly in contact with this package window part 32.

[0026] Since wiring can be divided and formed on the semiconductor chip with which the semi-conductor light emitting device 31 is formed, and the package window part 32 by forming a circuit pattern 42 in the whole surface of the package window part 32, simplification of a complicated multilayer-interconnection process can be attained.

[0027] Furthermore, compared with the conventional package structure, structure becomes very easy, and manufacture is easy, and is cheap and it is suitable for mass production method.

[0028] Drawing 2 shows the field luminescence laser array 48 which arranged 3x4 surface emission-type laser LD of a reflective mold 45 degrees. The lower wiring layer 49 is formed in a laser array side, other wiring layers (namely, circuit pattern) 41 are formed on the package window part 32 which consists of a transparence heat sink, and it consists of this field luminescence laser array 48. For example, the n mold GaAs layer formed for example, on the half-insulation GaAs substrate can constitute the lower wiring layer 49, and a laser diode array is formed on this n mold GaAs layer. Thus, when this invention is applied to the field luminescence laser array 48, simplification of a complicated multilayer-interconnection process can be attained.

[0029] Regardless of the example of drawing 1 , various deformation is possible for this invention. For example, it may replace with a resin mold object, and a semi-conductor light emitting device may be fixed with adhesives etc., and a whole surface deposit may be carried out by CVD.

[0030] Furthermore, on the package window part 32 which serves as this heat sink if needed, it is possible optical elements, such as a photodetector not only by the circuit pattern 41 but a hologram, the grating, the lens, the reflective film, and amorphous silicon and polycrystalline silicon, and to accumulate element components, such as a component circuit, further. Next, a modification is shown.

[0031] Drawing 3 shows other examples of the package of the semi-conductor light emitting device concerning this invention. In the configuration of drawing 1 , this example is replaced with the resin mold object 33, it fixes and the package window part 32 which consists of a semi-conductor light emitting device 31 and a transparence heat sink consists of resin adhesives 48 so that the circumference of the semi-conductor light emitting device 31 may be enclosed. Since other configurations are the same as that of drawing 1 , they give the same sign to a corresponding part, and omit duplication explanation.

[0032] With the semi-conductor light emitting device package 49 of drawing 3 , since the semi-conductor light emitting device 31 is fixed to the package window part 32 by the resin adhesives 48, structure becomes easy more and manufacture can be made easy.

[0033] In addition, since it is the configuration which stuck the package window part 32 which consists of a transparence heat sink on the side front from which the light of the semi-conductor light emitting device 31 which is a two-dimensional light emitting device is taken out like the example of drawing 1 , the good heat sink effectiveness over the semi-conductor light emitting device 31 is acquired. Moreover, effectiveness, like that simplification of a complicated multilayer-interconnection process is attained and it is suitable for mass production method is acquired.

[0034] Drawing 4 shows other examples of the package of the semi-conductor light emitting device concerning this invention. It is the case where the new optical coupling element 51 which comes to have the photodiode PD which is semiconductor laser LD and the photo detector which are a light emitting device which these people proposed previously as a semi-conductor light emitting device in this example. i.e., a CLC (KONFO cull laser coupler) device, is applied.
[0035] First, the optical coupling element 51 of a CLC device is explained using drawing 17 - drawing 19 . In this drawing, in 51, an optical coupling element and 62 show the irradiated section, and 63 shows a convergence means, i.e., a condensing optical lens.
[0036] It is unified on the common semi-conductor substrate 66, a light-emitting part 64 and a light sensing portion 65 change, and an optical coupling element 51 is the outgoing radiation light LF from a light-emitting part 64. Return light LR which carried out the focusing exposure and was reflected in the irradiated section 62 from this irradiated section 62 It is condensed by the focusing means 63, and it is constituted so that light may be received by the light sensing portion 65 arranged in the confocal location (a confocal location near [Strictly]) of the focusing means 63. With this configuration, the light from a light-emitting part 64 considers that optical axis as the configuration which passes the path of the same axle mutually behind as the chain line a shows, and is received in a light sensing portion 65, before being reflected in the irradiated section 62.
[0037] As shown in the enlarged drawing of drawing 19 , a light-emitting part 64 consists of semiconductor laser LD (however, 69 that stripe electrode) which has a level resonator, and a reflecting mirror 67, and a light sensing portion 65 is constituted from this optical coupling element 51 by the photodiode (PD).
Semiconductor laser LD is the future outgoing radiation light LF. It is made in agreement with the path which is reflected with a reflecting mirror 67 and goes to the irradiated section 62.
[0038] and return light LR which goes to a light sensing portion 65 It is what is converged to near the optical diffraction limitation (namely, diffraction limitation of a lens). When, as for a light sensing portion 65, some [that / at least] light-receiving sides set numerical aperture of lambda and the convergence means 63 to NA for the wavelength of the outgoing radiation light from a light-emitting part 64 in this optical diffraction limitation, The distance from the optical axis a of the outgoing radiation light from the light-emitting part 64 which crosses the arrangement datum level S of a light-receiving side is prepared in the location of less than 1.22 lambda/NA.
[0039] Moreover, as shown in drawing 18 and drawing 20 in this case, it is the outgoing radiation light LF of the light-emitting part 64 in the arrangement datum level S of the light-receiving side of a light sensing portion 65. Diameter phis Considering as smallness from diameter phid of the above-mentioned optical diffraction limitation, the effective light-receiving side of a light sensing portion 65 is diameter phis of luminescence. It is made to be located outside. Here, if semiconductor laser is used as the light source of a light sensing portion 64, it is diameter phis of the outgoing radiation light. It is about about 1-2 micrometers. On the other hand, when the numerical aperture NA of the convergence means 63 is [the wavelength lambda of 0.09 to 0.1 and outgoing radiation light] about 780nm about an optical coupling element 51 side, it is a diffraction limitation, i.e., phid. It becomes about 1.22 lambda/NA **10micrometer.
[0040] And a light-emitting part 64 is arranged in the focal location of 1 of the convergence means 63, and the irradiated section 62 is arranged in a confocal location. It is reflected in an outline perpendicular direction with a reflecting mirror 67, and the laser beam by which outgoing radiation was carried out from semiconductor laser LD of a light-emitting part 64 is irradiated by the irradiated section (for example, optical disk) 62 through the convergence means 63. The return light LR reflected from the irradiated section 62 at the time of a focus, i.e., return light reflected including the recording information in the irradiated section 62, It returns, and is again condensed by the convergence means 63, incidence of the same optical path is carried out

to the photodiode of the light sensing portion 65 arranged near the confocal location, and it is this return light LR. Light-receiving detection comes to be carried out by the light sensing portion 65. That is, it is changed into an electrical signal and taken out as a signal (for example, regenerative signal).

[0041] The example of representation of the manufacture approach of an optical coupling element 51 is explained here using drawing 21 and drawing 22 . This example is the case where it manufactures by alternative MOCVD. As shown in drawing 21 A, each semi-conductor layer which constitutes semiconductor laser on the substrate 66 which consists of a GaAs substrate which makes a principal plane the crystal face (100) of the 1st conductivity type, for example, n mold, is grown epitaxially. That is, the laminating semi-conductor layer which carried out epitaxy of the 2nd cladding layer 73 which consists of AlGaAs of the 2nd different conductivity type, for example, p mold, from the 1st cladding layer 71 72 which consists of AlGaAs of a substrate 6 and this conductivity type one by one, for example, for example, the barrier layer which consists of GaAs, and the 1st cladding layer 71 by MOCVD etc. one by one is constituted.

[0042] Next, as shown in drawing 21 B, the part which leaves a part of semi-conductor layers 73, 72, and 71 which these-grew epitaxially as semiconductor laser LD, and finally forms a reflecting mirror at least is etched by RIE (reactive ion etching) etc. And the both-ends side of the semi-conductor layer by this etching side is made into the resonator end faces 55A and 55B, respectively, and the level resonator of semiconductor laser LD is constituted between both-ends side 55A and 55B. In this case, although not illustrated, a current inhibition field is formed by the ion implantation of an impurity so that it may face across the field which finally constitutes the resonator of semiconductor laser LD.

[0043] Subsequently, as shown in drawing 21 C, covering formation of the insulating layers, such as the mask layer 74 2 of alternative MOCVD, for example, SiO, and SiN, is carried out so that the configuration section of the laminating semi-conductor layer left behind on the substrate 66, i.e., semiconductor laser LD, may be covered.

[0044] Next, as shown in drawing 22 D, the 1st semi-conductor layer 75 by GaAs of the 1st conductivity type, for example, n mold, is alternatively formed by MOCVD on the substrate 66 which is not covered with the mask layer 74.

[0045] Then, as shown in drawing 22 E, the 2nd semi-conductor layer 76 by GaAs of the 2nd conductivity type, for example, p mold, is alternatively formed by MOCVD, and Photodiode PD is formed by the 1st and 2nd semi-conductor layers 75 and 76.

[0046] Next, as shown in drawing 22 F, etching removal of the mask layer 74 is carried out, the electrodes 77 and 78 of one way each of semiconductor laser LD and Photodiode PD are put on OMIKKU, respectively, and the electrode 79 common to the rear face of a substrate 66 is put on the part on semiconductor laser LD and the 2nd semi-conductor layer 76 at OMIKKU.

[0047] In this case, it becomes the semi-conductor layer by which epitaxial growth was alternatively carried out on the substrate 66 of drawing 22 D, and the crystal face as which resonator end-face 55A of the 1st semi-conductor layer 75 and the field 80 which counters were specified in this example. For example, the direction of cavity length of the level resonator of the semiconductor laser formed between end-face 55A of semiconductor laser, and 55B, That is, among drawing 22 F, when it is generated as a slant face according [an opposed face 80] to {111} A when making into [011] crystal orientations the direction shown by the arrow head b and Direction b is made into [0-11] crystal orientation, it is generated as a slant face by {111} B, and in all, the angle with the plate surface of a substrate 66 to make becomes 54.7 degrees. Moreover, when making Direction b into [100] crystal orientations, it is generated as {110} and an opposed face 80 makes 45 degrees to the field of a substrate 66. All are formed as a slant face 80 with the sufficient morphology by the atomic plane.

[0048] Therefore, about the slant face 80 by the specified crystal face which was formed by doing in this way, as shown in drawing 22 F, it is the outgoing radiation light LF from end-face 55A of the level resonator of semiconductor laser LD. It can consider as the reflecting mirror 67 which is made to reflect and is turned in the predetermined direction. According to this configuration, since a reflecting mirror 67 is formed of the crystal face, it excels in mirror plane nature, and a setup of that inclination is performed correctly.
[0049] A deer is carried out, and in this example, as shown in drawing 4 A, it consists of the optical coupling element 51 as a semi-conductor light emitting device mentioned above, the package window part 32 which consists of a heat sink of a transparent ingredient to the wavelength of the light (and return light) L outputted from semiconductor laser LD of this optical coupling element 51, and the resin mold object 33 which closes an optical coupling element 51. The same ingredient as above-mentioned drawing 1 can be used for the ingredient which constitutes the package window part 32.
[0050] At this example, the predetermined electrode pattern 41 is especially formed in the component side of the optical coupling element 51 of the package window part 32, and while forming so that an opposite side, i.e., the side front side of the package window part 32, may be faced that electrode pad 42 with a component side, a hologram 52 is made from optical elements, such as a hologram and a grating, and this example to this package window part 32.
[0051] And through the solder layer 43 [43A, 43B], it sticks on the package window part 32 by the so-called junction down, and fixes so that the field by the side of this optical coupling element 51, i.e., semiconductor laser LD of that level resonator, may be opposite-**(ed) to the circuit pattern 41 of the package window part 32, and the resin mold object 33 is formed from the rear-face side of an optical coupling element 51, and the semi-conductor light emitting device package 54 is constituted. A hologram 52 is formed so that it may correspond to the location where the light from semiconductor laser LD penetrates the package window part 32.
[0052] It is prepared in the confocal location at which the zero-order light of the return light which passed the hologram 52, for example arrives as a light sensing portion, and each location at which for example, +primary light and -primary light arrive. As shown in drawing 4 B, this semi-conductor light emitting device package 54 is mounted through the electrode pad 42 so that the side front of the package window part 32 may serve as facing down to the component-mounting substrate 46.
[0053] In the semi-conductor light emitting device package 54 of this configuration, much more functions can be given by making optical elements, such as a hologram 52 and a grating, to the package window part 32 which serves as a heat sink. In addition, the same operation effectiveness is done so with the example of drawing 1 having explained.
[0054] Next, an example of the manufacture approach of the above-mentioned semi-conductor optical element package 54 is explained using drawing 5 and drawing 6 .
[0055] First, as shown in drawing 5 A, transparence substrate 32A used as the package window part 32 of heat sink combination is prepared, and the through hole 57 for forming an electrode pad for every field section used as each package window part is formed.
[0056] next, as shown in drawing 5 B, the predetermined circuit pattern 41 is formed, respectively on whole surface 32a corresponding to each field section of transparence substrate 32A, and it connects with this circuit pattern 41 -- as -- a through hole 57 -- letting it pass -- transparence substrate 32A -- the electrode pad 42 is formed so that the 32b side may be attended on the other hand. Furthermore, the solder layer 43 [43A, 43B] is formed on a circuit pattern 41.
[0057] next, it is shown in drawing 5 C -- as -- transparence substrate 32A -- on the other hand, a hologram 52 is formed in the predetermined location of 32b.

[0058] Next, as shown in drawing 6 D, an optical coupling element 51 is stuck on the circuit pattern 41 side of transparence substrate 32A by junction down, and it fixes. An optical coupling element 51 is joined to a circuit pattern 41 by junction down. The substrate side of an optical element 51 is also connectable with other circuit patterns 41 by wire bonding.
[0059] Next, as shown in drawing 6 E, whole surface resin mold is carried out so that each optical coupling element 51 may be covered, and the resin mold object 33 is formed.
[0060] As shown in drawing 6 F after an appropriate time, dicing processing is performed, it divides into two or more packages, and the semi-conductor light emitting device package 54 to come to cover an optical coupling element 51 with lamination and a resin mold object to the package window part 32 of the transparence heat sink with which the hologram 52 was formed in the optical coupling element 51 is obtained.
[0061] According to this manufacture approach, a production process is compacted extremely, and the semi-conductor light emitting device package 54 is easy structure, and it is miniaturized extremely. Therefore, it is fit for mass production method, and becomes advantageous to reduction-izing of a manufacturing cost, the miniaturization of a product, etc.
[0062] Drawing 7 and drawing 8 show other examples of the manufacture approach using a leadframe. As shown in drawing 7 A, transparence substrate 32A used as the package window part 32 of heat sink combination is prepared, a predetermined circuit pattern 41 and the predetermined electrode pad 42 are formed, respectively on whole surface 32a of the field section used as each package window part, and the solder layer 43 [43A, 43B] is formed on a circuit pattern 41.
[0063] next, it is shown in drawing 7 B -- as -- each field section of transparence substrate 32A -- on the other hand, a hologram 52 is formed in the predetermined location of 32b.
[0064] Next, as shown in drawing 7 C, an optical coupling element 51 is stuck on the circuit pattern 41 side of transparence substrate 32A by junction down, and it fixes.
[0065] Next, as shown in drawing 8 D, dicing divides transparence substrate 32A so that each optical coupling element 51 may be separated.
[0066] The package window part 32 in the condition that each optical coupling element 51 was fixed is joined to a leadframe 58 through the electrode pad 42 the appropriate back, subsequently resin mold is given, and the resin mold object 33 is formed. Thus, the semi-conductor light emitting device package 59 made into the purpose of the form which drew the lead is obtained.
[0067] According to this manufacture approach, the semi-conductor light emitting device package 59 suitable for mounting which needed the lead section can manufacture easily.
[0068] Drawing 9 shows other examples of the package of the semi-conductor light emitting device concerning this invention.
[0069] The package window part 92 by ingredients, such as the transparent material whose heat conductivity is not not much high as a package window part, for example, plastics etc., is used for this example. The metal thickness film heat sink 93 which serves as a circuit pattern on the whole surface of this package window part 92 using plating etc. is formed. In this example, it is formed so that the front face of the package window part 92 may be faced the electrode pad 42 linked to the thick-film heat sink 93. And lamination and the resin mold object 33 are formed in the circuit pattern 93 of this thick-film heat sink for an optical coupling element 51 through the solder layer 43 [43A, 43B], and the semi-conductor light emitting device package 94 is constituted.
[0070] Since the circuit pattern 93 which serves as a thick-film heat sink to the plate-like package window part 92 is formed according to the semi-conductor light emitting device package 94 of this configuration, it can constitute easily rather than it forms in the light emitting device which is irregular like the example shown

in drawing 24 directly. Moreover, since the transparent materials (for example, plastics etc.) which are not high as for the heat conductivity can be used as a package window part 92, the advantageous semi-conductor light emitting device package in cost can be constituted.

[0071] Drawing 10 shows other examples of the package of the semi-conductor light emitting device concerning this invention. The semi-conductor light emitting device package 97 of this example consists of a package window part 32 which consists of a transparence heat sink, and an optical coupling element 51 and the resin mold object 33, and an optical element 52, i.e., a hologram, and a grating 96 are made to both sides of the package window part 32, and it constitutes them to them. According to an application, the usual lens, a Fresnel lens, prism, etc. are made to the package window part 32, and can also be multi-functionalized to it. Since other configurations are the same as that of drawing 4 , the same sign is given to a corresponding part and duplication explanation is omitted.

[0072] Drawing 11 shows other examples of the package of the semi-conductor light emitting device concerning this invention. As an optical element is not made to the package window part 32 which consists of a transparence heat sink and it is shown in drawing 10 , the semi-conductor light emitting device package 99 of this example forms an optical element 52, for example, a hologram, and a grating 96 in both sides of another transparence plate 101, is stuck on a front face opposite to the field where this transparence plate 101 was stuck on the optical coupling element 51 of the package window part 32, and constitutes them. Since other configurations are the same as that of drawing 1 A, they give the same sign to a corresponding part, and omit duplication explanation.

[0073] According to the semi-conductor light emitting device package 99 of this configuration, although components mark increase by addition of another transparence plate 101, since the hologram 52 of an optical element and the alignment of a grating 96 can carry out after mounting of a light emitting device or a photo detector (i.e., this example) after mounting to the package window part 32 of an optical coupling element 51, it is convenient for what needs the alignment of a high precision, and becomes advantageous to the yield etc. Moreover, ** will become possible, if the usual lens, a Fresnel lens, prism, etc. are made to another transparence plate 101 and multi-functionalized to it according to an application.

[0074] Drawing 12 shows other examples of the package of the semi-conductor light emitting device concerning this invention. The semi-conductor light emitting device package 103 of this example is not a laser side, and makes to the package window part 32 side, the photo detector PD, i.e., the photodiode, of an optical coupling element 51 which is a CLC device.

[0075] That is, the photodiode PD by the amorphous silicon by plasma CVD or polycrystalline silicon is formed in the location corresponding to semiconductor laser LD and a reflector 67, and the wiring 104 of Photodiode PD is formed at the whole surface of the package window part 32 which consists of a transparence heat sink. 105 is an insulator layer for protecting Photodiode PD. The necessary circuit pattern 41 for a chip is formed including this insulator layer 105. the package window part 32 -- on the other hand -- being alike -- an optical element 52, for example, a hologram, is formed. And the resin mold object 33 is formed in the package window part 32 from the rear face of lamination and an optical coupling element 51, and the semi-conductor light emitting device package 103 is constituted so that an optical coupling element 51 may be connected to a circuit pattern 41 through the solder layer 43 [43A, 43B].

[0076] In an optical coupling element 51, in case the photodiode PD which is a photo detector is made to a laser side, although it is easy to make on a reflector 67, on Laser LD, it is difficult to take independently and it cannot make the electrode of Laser LD and Photodiode PD easily. However, according to the semi-conductor light emitting device package 103 of drawing 11 , since Photodiode PD is formed on the package window part 32, the above-mentioned problem can be solved and light-receiving effectiveness can be gathered.

[0077] Drawing 13 shows other examples of the package of the semi-conductor light emitting device concerning this invention. The semi-conductor light emitting device package 107 of this example is set in the semi-conductor light emitting device package 103 of drawing 12 . The include angle alpha of the reflector 67 of an optical coupling element 51 is made into a larger include angle than 45 degrees. Outgoing radiation light LF The photodiode PDc (for example, for laser output monitors) by the side of the laser LD of the photodiode PD [PDa, PDb, and PDc] which reflected the part on the front face of the package window part 32, and was formed in the package window part 32 is made to receive light. return light LR it reflects within the package window part 32 -- making -- the photodiode PDa the object for the focus servo signal detection by the side of a reflector 67, or for truck servo signal detection, and PDb It constitutes so that light may be received. Although drawing 13 shows only the important section, since it is the same as that of drawing 12 , other configurations are omitted.

[0078] In addition, although considered as the configuration in which the inside of the package window part 32 was reflected in this example, another transparence plate can be arranged on the package window part 32, and this transparence plate can also be used for reflection.

[0079] Drawing 14 shows other examples of the package of the semi-conductor light emitting device concerning this invention. The semi-conductor light emitting device package 109 of this example accumulates the optical coupling element 51 and IC110 for an operation of a CLC device by the hybrid on the package window part 32 which consists of a transparence heat sink, and the whole surface mold of it is carried out, and it forms and constitutes the resin mold object 33 from a tooth back. In addition, the same sign is given to drawing 4 and a corresponding part, and duplication explanation is omitted.

[0080] Since the whole surface is covered for a tooth back with the resin mold object 33 with this configuration, IC110 for an operation can be shut up completely optically, and there are also no problems, such as malfunction by the stray light from an optical coupling element 51.

[0081] Also in each semi-conductor light emitting device packages 94, 97, and 99,103,107,109 mentioned above, the same operation effectiveness is done so with the example of drawing 1 having explained. Each example of the semi-conductor light emitting device package using the optical coupling element 51 of a CLC device is applicable to the optical pickup of optical disk drives, such as the so-called compact disk (CD) player and a magneto-optic-disk player.

[0082] On the other hand, this invention is advantageous also to the application to perpendicular resonator side luminescence laser.

[0083] Drawing 15 shows other examples of the package of the semi-conductor light emitting device concerning this invention applied to perpendicular resonator side luminescence laser. In this example, the 1st reflective film (n mold) 113 which consists of semi-conductor multilayers and dielectric multilayers of high reflection is formed, for example on n mold substrate 112. While forming the 1st cladding layer 114, a barrier layer 115, the 2nd cladding layer 116 and the 1st reflective film 113, and the 2nd same reflective film (p mold) 117 on this reflective film 113 The outgoing radiation side side of the perpendicular resonator side luminescence laser 120 which forms the current block layer 118 in both sides, forms the cap layer 119 further, and carries out field generating perpendicularly by the current impregnation A Lamination and a tooth back are covered with the resin mold object 33 through the solder layer 43 to the field where the circuit pattern 41 was formed in the package window part 32 which consists of a transparence heat sink, and the semi-conductor light emitting device package 121 is constituted.

[0084] Also in this configuration, while the package window part 32 is penetrated and light carries out outgoing radiation, this package window part 32 serves as a heat sink, and makes good heat dissipation of a surface emission-type laser.

[0085] Generally, since perpendicular resonator side luminescence laser has semi-conductor multilayers and dielectric multilayers of high reflection, it is hard to carry out current impregnation A, and resistance between components becomes high. Therefore, generation of heat is large and has big effect on the effectiveness and the engine performance of a component.
[0086] Drawing 16 shows the example of further others of the package of the semi-conductor light emitting device concerning this invention applied to perpendicular resonator side luminescence laser. The semi-conductor light emitting device package 122 of this example forms in the package window part 32 side the 2nd reflective film 117 of the front-side which carries out outgoing radiation of the light, and constitutes it. Other configurations are the same as drawing 15 , give the same sign to a corresponding part, and omit duplication explanation.
[0087] With this configuration, although it is hard coming to make, if micro cavity structure is laser with a comparatively longer resonator, it is using as reflective film by the side of p, and can reduce the problem of current impregnation considerably.
[0088] The actual process and the structure of the semi-conductor light emitting device package 103 are explained more to a detail using drawing 12 and drawing 17 . As drawing 17 A (sectional view) and drawing 17 B (top view) show the optical coupling element 51 which is a CLC device, semiconductor laser LD of the level resonator with which the stripe electrode 132 was formed in the center on a semi-conductor substrate is formed, resonator end-face 55A of one of these is countered, and a reflector 67 is formed. The separation slot 39 is minded [which counters resonator end-face 55B of another side], and it is the photodiode PD 2 for monitors. It is formed. photodiode PD 3 for tracking servos in the field top by the side of a reflector 67 Photodiodes [PD / PD and / 5] 4 for focus servos with a metal grid to the both sides which sandwich this it forms -- having -- each photodiodes [PD / PD, PD /3 /, and / 4] 2 and PD5 from -- the polar zone 130 for contact is formed. The metal layer 131 for seals is formed in the periphery enclosure on a substrate 66.
[0089] The external electrode (namely, electrode pad) of a package 103 can use properly the form which used the through hole, and the form of only one side by the application. It is formed with aluminum etc. and an external electrode (namely, electrode pad) and internal wiring (namely, circuit pattern) are a front face SiO2 Or/and, it is protected by SiN etc. The metal layer 131 for seals, and each photodiodes [PD / PD, PD /3 /, and / 4] 2 and PD5 Patterning of solder 43 or the Au electrode is carried out, and the part equivalent to the polar zone 130 for contact is connected with the circuit patterns 41, such as aluminum.
[0090] In the mounting process to the package window part 32 of an optical coupling element 51, since it is easy to carry out a microscope monitor optically from the bottom by drawing 11 when using patterning of solder, very precise location precision **** becomes possible.
[0091] although mounting of an optical coupling element 51 is an individual process -- the one package window part 32 (namely, silicon on sapphire with a diameter of 3 inches) top -- many optical coupling elements 51 -- mounting -- solder -- since it can carry out by bundling up like a heat process and becomes the so-called batch process, a routing counter can be reduced. Moreover, it is also possible to perform adhesion of Au layer and Au layer ultrasonically besides solder.
[0092] In connection of both sides, an optical coupling element 51 turns into a component which was very excellent in the field of temperature-proof and dependability according to the metal structure for seals by carrying out the closure of the whole by the metal layer for seals, the semi-conductor substrate, and the package window part.
[0093] Rather than the resistance to environment of an optical coupling element, whole surface mold is the purpose which prevents a GaAs substrate being exposed, therefore has some spreading means. For example, the coarse DIP process of texture is also enough as an epoxy heat-curing type, (ultraviolet-rays UV) hardening

mold resin, etc. which carried out spin coating.

[0094] In dicing, the so-called full cutting process in silicon is performed, and the whole wafer thickness is cut off by the dicer. Therefore, this optical coupling element by which packaging was carried out can be handled with the same feeling as the usual semi-conductor pellet, and its PD top is also simple. That is, automatic mounting to a substrate becomes possible easily like the chip on a pressure sensitive adhesive sheet.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] A It is the sectional view showing one example of the semi-conductor light emitting device package concerning this invention.

B It is the sectional view showing the condition of having mounted the semi-conductor light emitting device package concerning this invention in the component-mounting substrate.

[Drawing 2] It is the perspective view of an important section showing other examples of the semi-conductor light emitting device package concerning this invention applied to the field luminescence laser array.

[Drawing 3] A It is the sectional view showing other examples of the semi-conductor light emitting device package concerning this invention.

B It is the sectional view showing the condition of having mounted the semi-conductor light emitting device package concerning this invention in the component-mounting substrate.

[Drawing 4] A It is the sectional view showing other examples of the semi-conductor light emitting device package concerning this invention.

B It is the sectional view showing the condition of having mounted the semi-conductor light emitting device package concerning this invention in the component-mounting substrate.

[Drawing 5] A It is process drawing showing one example of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

B It is process drawing showing one example of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

C It is process drawing showing one example of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

[Drawing 6] D It is process drawing showing one example of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

E It is process drawing showing one example of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

F It is process drawing showing one example of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

[Drawing 7] A It is process drawing showing other examples of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

B It is process drawing showing other examples of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

C It is process drawing showing other examples of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

[Drawing 8] D It is process drawing showing other examples of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

E It is process drawing showing other examples of the manufacture approach of the semi-conductor light emitting device package concerning this invention.

[Drawing 9] It is the sectional view showing other examples of the semi-conductor light emitting device package concerning this invention.

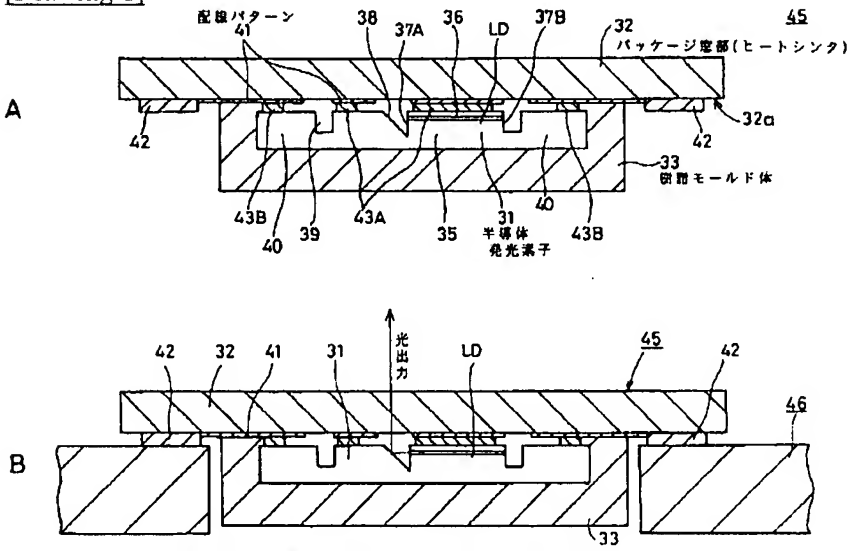
[Drawing 10] It is the sectional view showing other examples of the semi-conductor light emitting device

package concerning this invention.
[Drawing 11] It is the sectional view showing other examples of the semi-conductor light emitting device package concerning this invention.
[Drawing 12] It is the sectional view showing other examples of the semi-conductor light emitting device package concerning this invention.
[Drawing 13] It is the sectional view of an important section showing other examples of the semi-conductor light emitting device package concerning this invention.
[Drawing 14] It is a sectional view in the condition of having mounted in the component-mounting substrate in which other examples of the semi-conductor light emitting device package concerning this invention are shown.
[Drawing 15] It is the sectional view of an important section showing other examples at the time of applying this invention to a perpendicular resonator side light emitting device.
[Drawing 16] It is the sectional view of an important section showing the example of further others at the time of applying this invention to a perpendicular resonator side light emitting device.
[Drawing 17] A It is the sectional view showing the example of the optical coupling element of a CLC device.
B It is the top view showing the example of the optical coupling element of a CLC device.
[Drawing 18] It is the block diagram with which explanation of the optical coupling element concerning this invention is presented.
[Drawing 19] It is the expansion perspective view of the important section of the optical coupling element of drawing 18 .
[Drawing 20] It is the explanatory view of an optical coupling element.
[Drawing 21] A It is the production process Fig. of the typical manufacture approach of an optical coupling element.
B It is the production process Fig. of the typical manufacture approach of an optical coupling element.
C It is the production process Fig. of the typical manufacture approach of an optical coupling element.
[Drawing 22] D It is the production process Fig. of the typical manufacture approach of an optical coupling element.
E It is the production process Fig. of the typical manufacture approach of an optical coupling element.
F It is the production process Fig. of the typical manufacture approach of an optical coupling element.
[Drawing 23] It is the sectional view of the two-dimensional semi-conductor light emitting device with which explanation of this invention is presented.
[Drawing 24] It is the sectional view of the two-dimensional semi-conductor light emitting device with which explanation of this invention is presented.
[Drawing 25] It is the sectional view showing an example of the conventional semi-conductor light emitting device package.
[Drawing 26] It is the sectional view showing the other examples of the conventional semi-conductor light emitting device package.
[Description of Notations]
31 Semi-conductor Light Emitting Device
32 Package Window Part Which Consists of a Transparence Heat Sink
33 Resin Mold Object
35 Semi-conductor Substrate
LD Laser diode
PD Photodiode

41 Circuit Pattern
42 Electrode Pad
43 [43A, 43B] Solder layer
51 Optical Coupling Element
52 Hologram
96 Grating

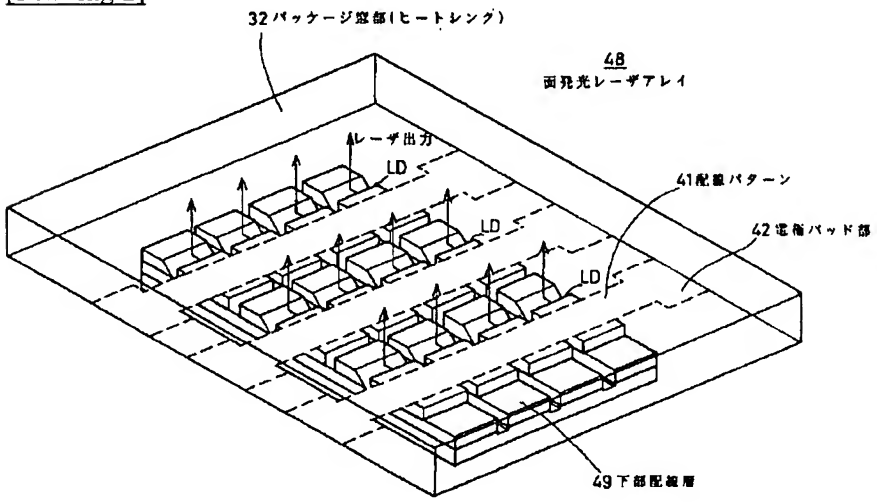
DRAWINGS

[Drawing 1]



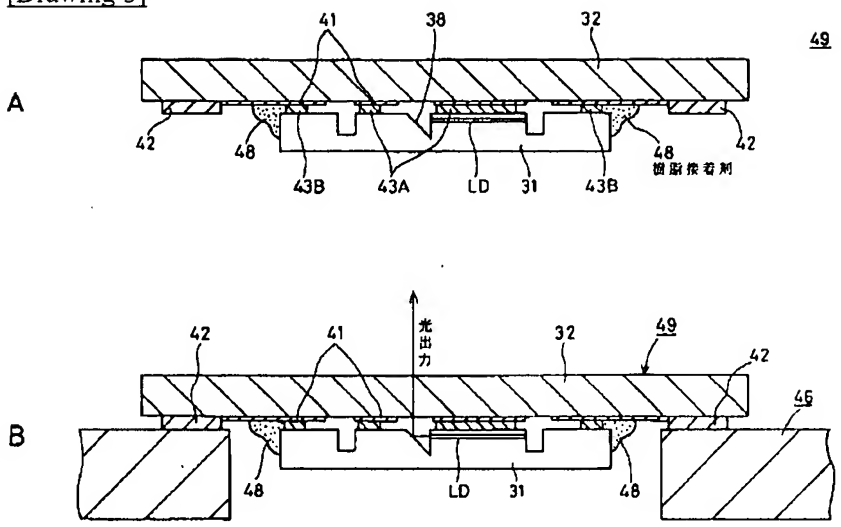
第１実施例及び実装状態の断面図

[Drawing 2]



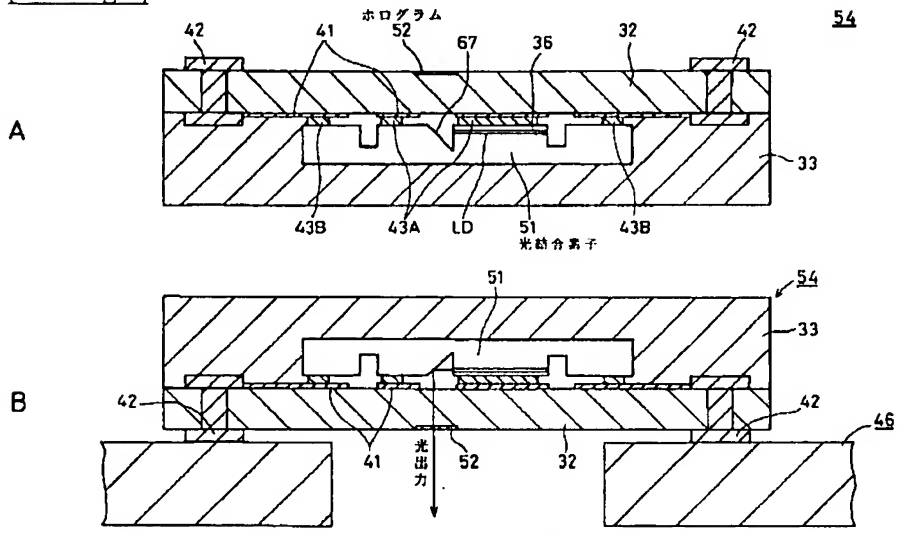
第２実施例の要部の斜視図

[Drawing 3]



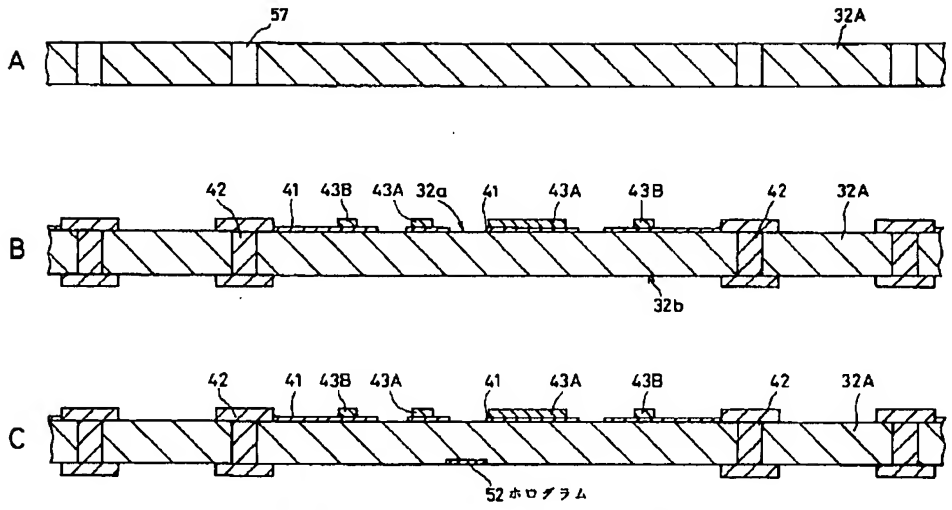
第３実施例及び実装状態の断面図

[Drawing 4]



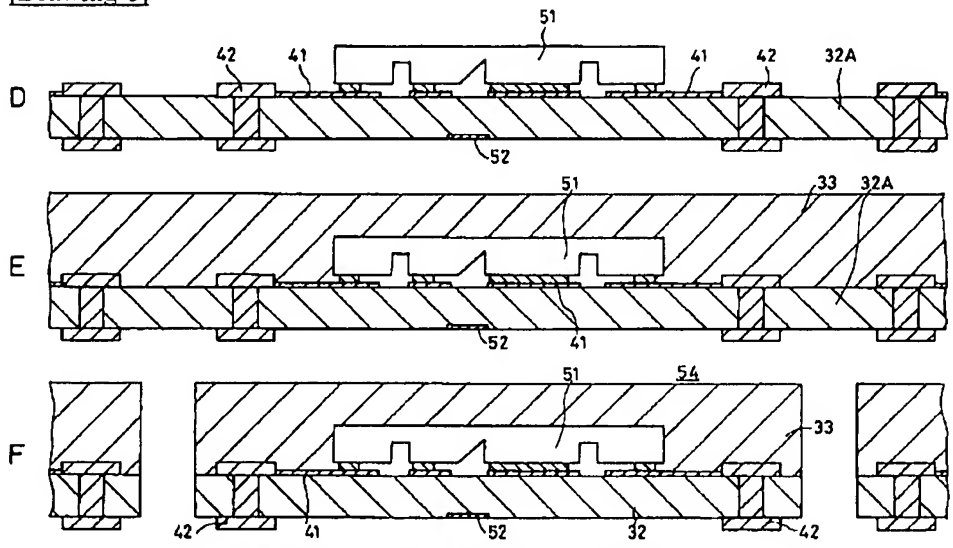
第４実施例及び実装状態の断面図

[Drawing 5]



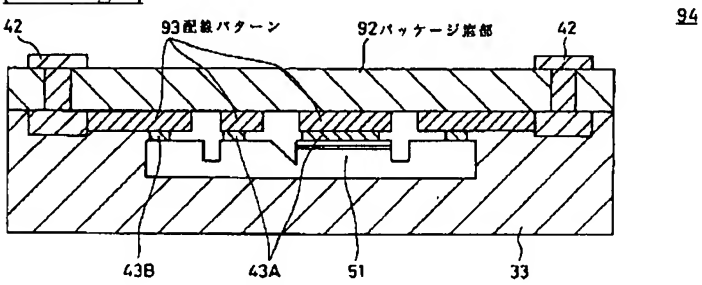
製造方法の第１実施例の工程図（その１）

[Drawing 6]



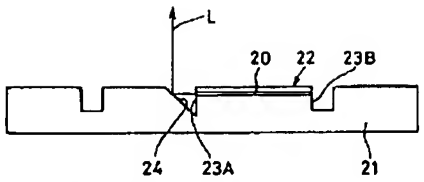
製造方法の第１実施例の工程図（その２）

[Drawing 9]



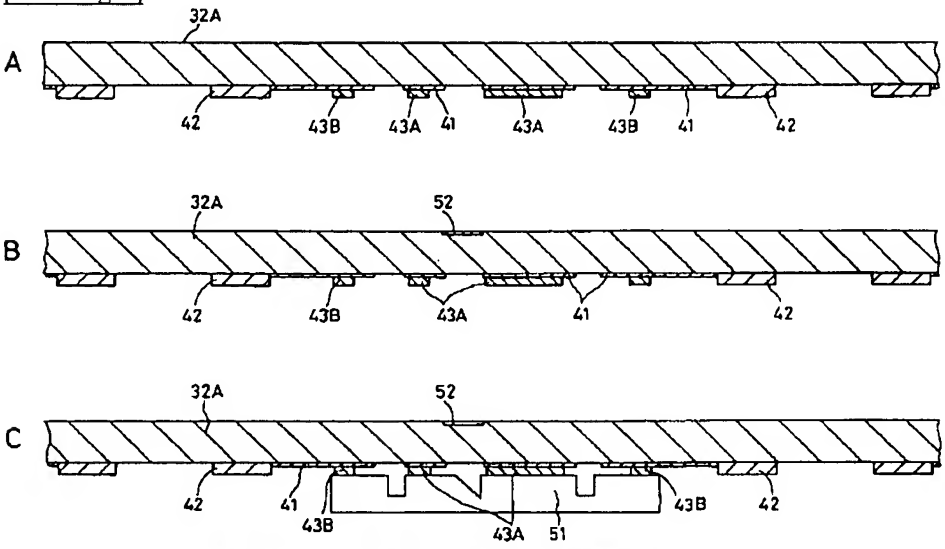
第５実施例の断面図

[Drawing 23]



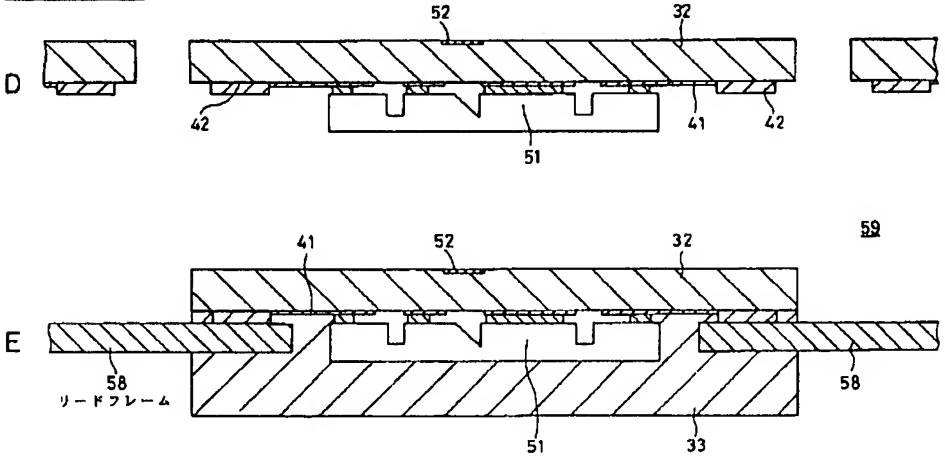
本発明の説明に供する
面型半導体発光素子の断面図

[Drawing 7]



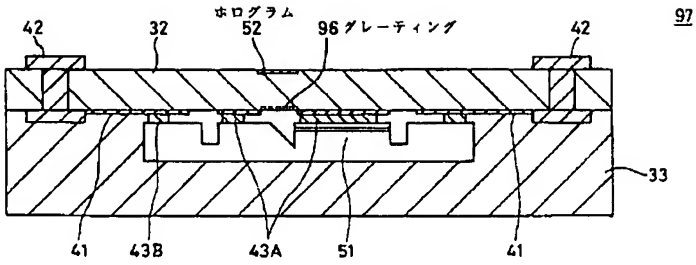
製造方法の第２実施例の工程図（その１）

[Drawing 8]



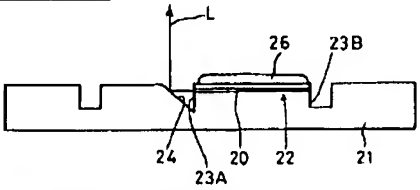
製造方法の第２実施例の工程図（その２）

[Drawing 10]



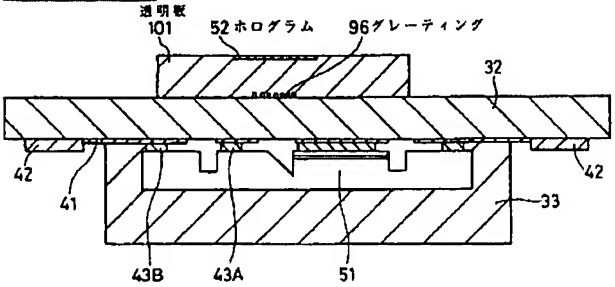
第6実施例の断面図

[Drawing 24]



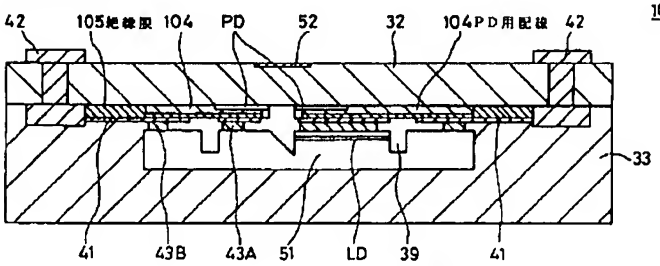
本発明の説明に供する
面型半導体発光素子の断面図

[Drawing 11]



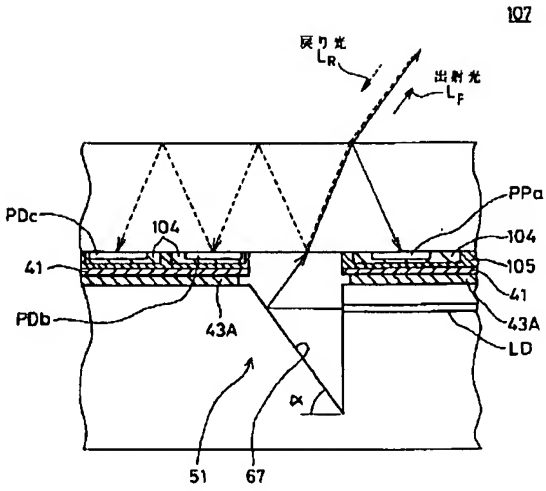
第7実施例の断面図

[Drawing 12]



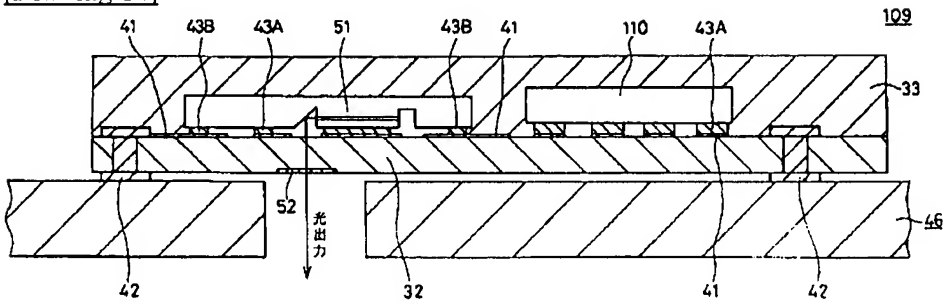
第8実施例の断面図

[Drawing 13]



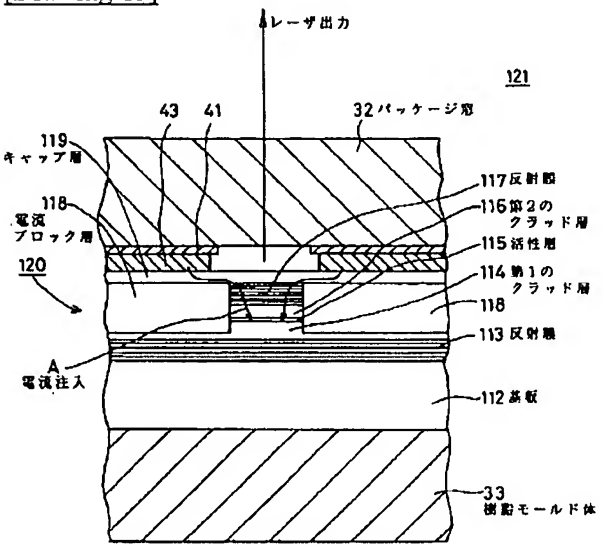
第９実施例の要部の断面図

[Drawing 14]



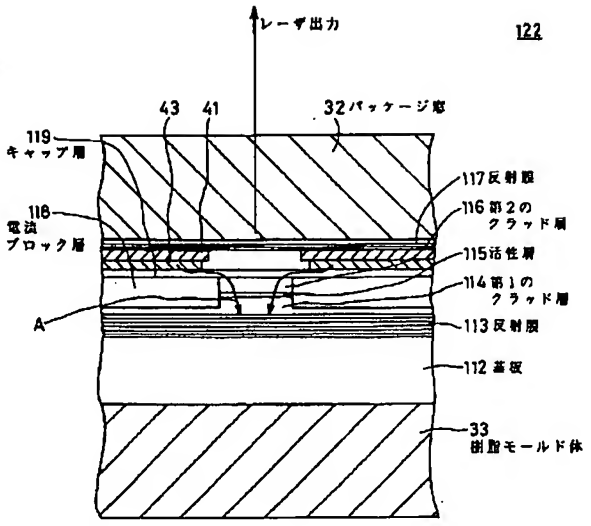
第１０実施例に係る実装状態の断面図

[Drawing 15]



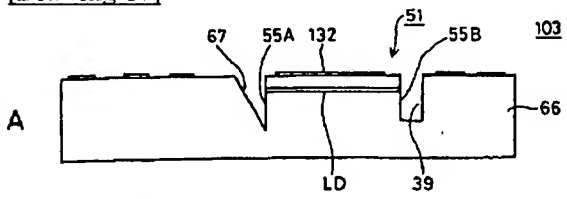
第１１実施例に係る
垂直共振器面発光素子の要部の断面図

[Drawing 16]

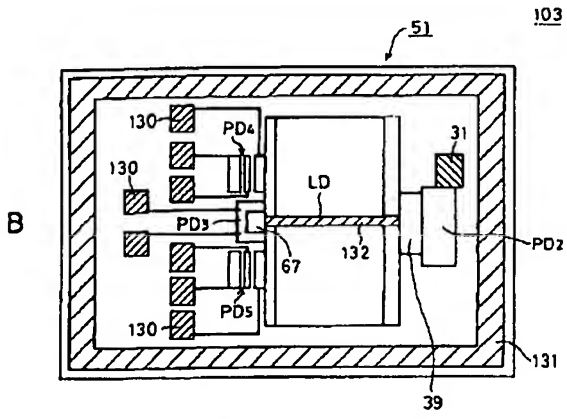


第１２実施例に係る
垂直共振器面発光素子の要部の断面図

[Drawing 17]



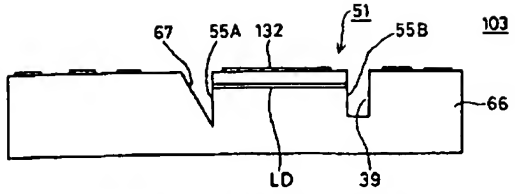
光結合素子の具体例の断面図



光結合素子の具体例の平面図

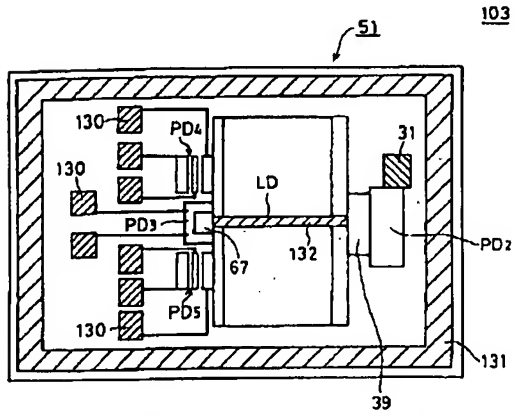
[Drawing 17]

A



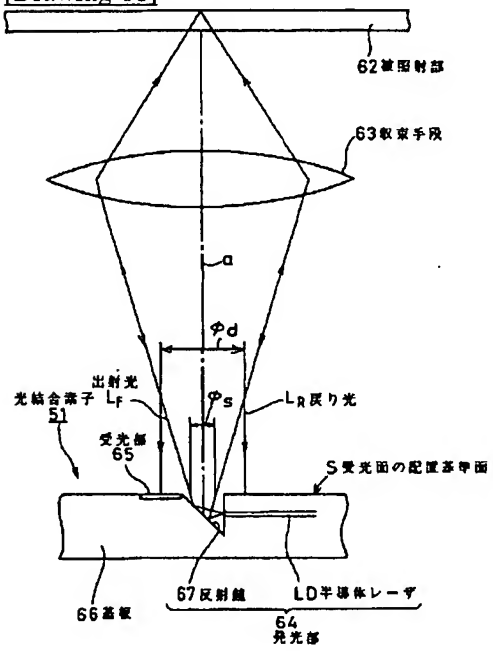
光結合素子の具体例の断面図

B



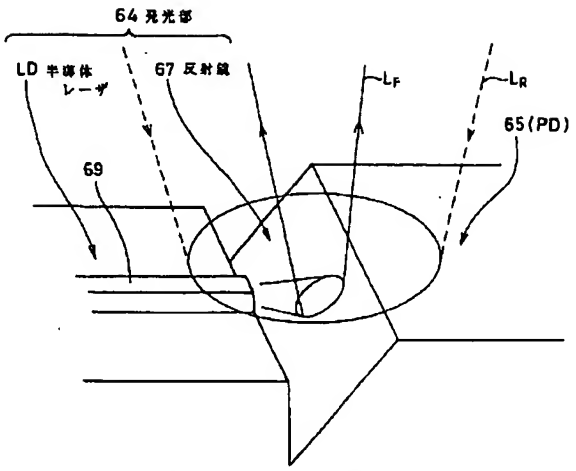
光結合素子の具体例の平面図

[Drawing 18]



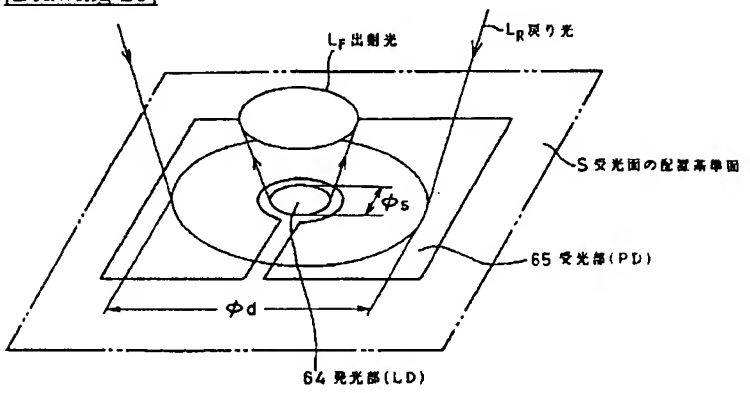
光結合素子の構成図

[Drawing 19]



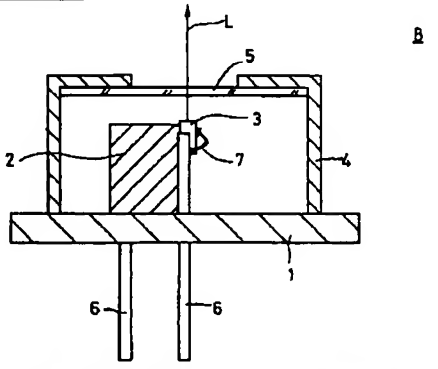
要部の拡大斜視図

[Drawing 20]



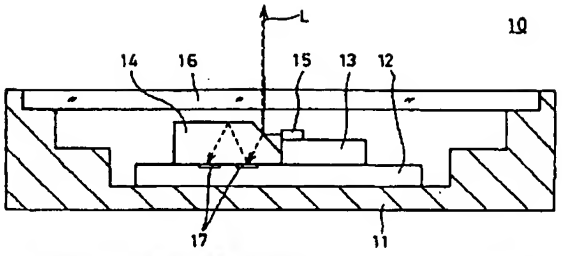
光結合素子の説明図

[Drawing 25]



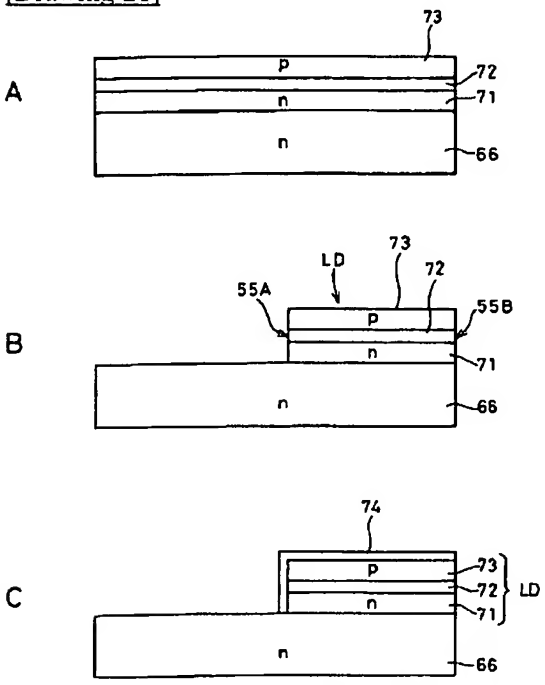
従来の半導体発光素子
パッケージの一例の断面図

[Drawing 26]



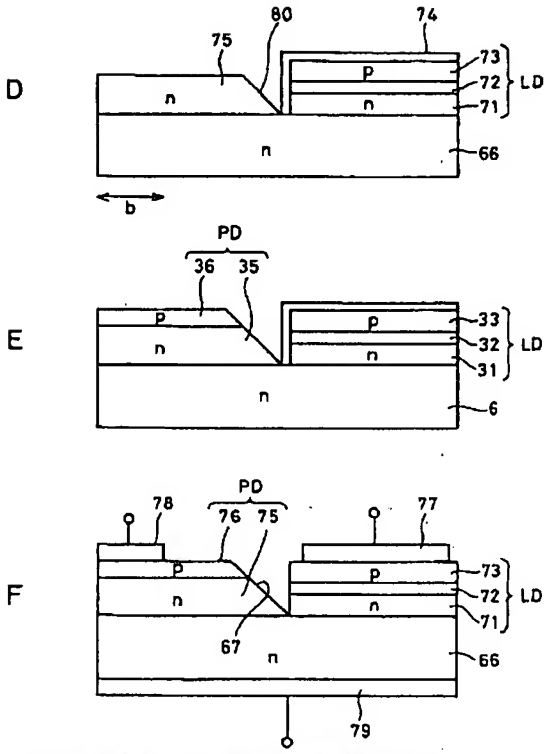
従来の半導体発光素子
パッケージの他例の断面図

[Drawing 21]



光結合素子の代表的な製造工程図（その１）

[Drawing 22]



光結合素子の代表的な製造工程図（その２）

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特開平8－186326

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Ｈ０１Ｓ　3/18				

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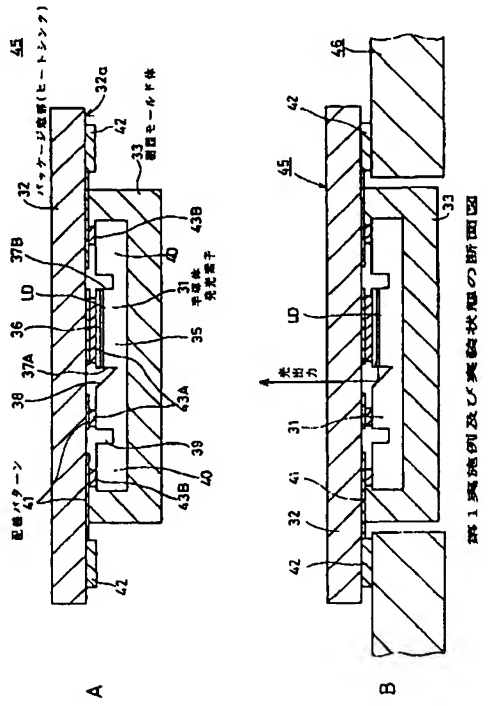
最終頁に続く

(54)【発明の名称】　半導体発光素子のパッケージ及びその製造方法

(57)【要約】

【目的】　素子の表側に光を出しながら且つ表側から放熱を可能にした面型半導体発光素子のパッケージを得る。

【構成】　半導体基板に対し上側に発光する半導体発光素子と、透明ヒートシンクよりなるパッケージ窓部とを有し、パッケージ窓部の発光素子側には配線パターンが形成されてなり、配線パターンに対応して半導体発光素子が貼り合わせてた構成とする。



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【特許請求の範囲】

【請求項１】　半導体基板に対し上側に発光する半導体発光素子と、透明ヒートシンクよりなるパッケージ窓部とを有し、前記パッケージ窓部の前記発光素子側には配線パターンが形成されてなり、該配線パターンに対応して前記半導体発光素子が貼り合わせて成ることを特徴とする半導体発光素子のパッケージ。

【請求項２】　前記パッケージ窓部に要素部品が形成されてなることを特徴とする請求項１に記載の半導体発光素子のパッケージ。

【請求項３】　透明ヒートシンク上に配線パターンを形成する工程と、前記透明ヒートシンクの配線パターン側に半導体基板に対し上側に発光する複数の半導体発光素子を貼り合わせる工程と、

前記複数の半導体発光素子を覆って樹脂により封止する工程と、

前記透明ヒートシンクをダイシングにより複数のパッケージに分割する工程とを有し、

前記透明ヒートシンクを前記パッケージの窓部とすることを特徴とする半導体発光素子のパッケージの製造方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、半導体発光素子のパッケージ及びその製造方法に関する。

【０００２】

【従来の技術】一般に、従来の半導体発光素子のパッケージングは、基本的にパッケージの底部分、あるいはサブマウント基板をヒートシンクとして用い、パッケージのキャップや窓に透明材料を用いて光を取り出すという方法を用いている。即ち、これまでの方法では、ヒートシンクと光を取り出す窓とは別々に形成していた。

【０００３】図２５及び図２６は、夫々従来の半導体発光素子をマウントしたパッケージの構造を示す。図２５の半導体発光素子パッケージ８は、基板１上にヒートシンク２を配置し、このヒートシンク２の一側にレーザダイオード３を取付けると共に、基板１上にレーザダイオード３及びヒートシンク２を被冠するキャップ４を取付け、このキャップ４にレーザダイオード３から出力される光Ｌを外部に放射するため透明窓５を形成して構成される。６は基板１を貫通して設けられた端子ピン、７はレーザダイオード３の電極と端子ピン６間を接続する金属細線である。

【０００４】図２６の半導体発光素子パッケージ１０は、ハイブリッド型構造であり、パッケージ構体１１内の底面に半導体基板を配置し、この半導体基板１２上にサブマウント基板（半導体基板）１３及びプリズム１４を配置し、このサブマウント基板１３上にレーザダイオード１５を取付け、パッケージ構体１１の上面に透明窓１６を取付けて構成される。この半導体発光素子パッケージ１０では、レーザダイオード１５から出力される光Ｌがプリズム１４の斜面で反射して透明窓１６を透過して外方に放射されるようになされる。また、光ピックアップとして構成されている場合には、ディスクで反射した戻り光が破線で示すようにプリズム１４内に入射し、半導体基板１２表面に形成された受光素子、即ちフォトダイオード１７にて受光されるようになされる。この構成では半導体基板１２及びサブマウント基板１３がレーザダイオード１５のヒートシンクとして作用する。

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【０００５】

【発明が解決しようとする課題】ところで、図２５の半導体発光素子パッケージ８のようにヒートシンク２側と光Ｌを取り出す側が同一でない場合や、図２６の半導体発光素子パッケージ１０のようにハイブリッド型の場合には、従来の方法で何とか構成できる。

【０００６】しかしながら、素子の表側に光を出しながら且つ表側にヒートシンクを必要とするような、例えばモノリシック型の面型発光素子、即ち、例えば図２３に示すように半導体基板２１に水平共振器からなるレーザダイオード２２が形成され（但し、２０は活性層を代表して示す）、共振器端面２３Ａ，２３Ｂのうちの一方の共振器端面２３Ａに対向して例えば４５°の反射面２４が形成され、共振器端面２３Ａから出力された光Ｌが反射面で反射されて垂直方向に出射されるような面型発光素子では、ヒートシンクが取付け難くなる。

【０００７】この場合、発光素子であるレーザダイオード２２を特に高効率なものにするとか、比較的低出力で用いるとか、パルス動作で用いる等、素子の構造上あるいは動作上の制約が出てくる。

【０００８】一応、図２４に示すように、メッキ技術等を利用して、レーザダイオード２２の表側の配線２６を厚くしてこの厚膜配線２６をヒートシンクの役割を担わせる方法も考えられるが、凹凸のある素子上に金属の厚膜を形成するのは簡単ではなく、必ずしも、十分なヒートシンク効果は得られない、即ち熱が外部に伝達しにくい場合が多い。

【０００９】本発明は、素子の表側に光を出しながら表側にヒートシンクを必要とするような、例えばモノリシック型の面発光素子において、上述のような問題点を克服できるようにした半導体発光素子のパッケージ及びその製造方法を提供するものである。

【００１０】

【課題を解決するための手段】第１の本発明に係る半導体発光素子のパッケージは、半導体基板３５に対し上側に発光する半導体発光素子３１（ＬＤ）と、透明ヒートシンクよりなるパッケージ窓部３２とを有し、パッケージ窓部３２の発光素子３１側には配線パターン４１が形成されてなり、配線パターン４１と対応して半導体発光素子３１が貼り合わされた構成とする。

【００１１】第２の本発明に係る半導体発光素子のパッ

ケージは、第1の発明において、パッケージ窓部３２に例えば光学素子等の要素部品５２，９６が形成された構成とする。

【００１２】第３の本発明に係る半導体発光素子のパッケージの製造方法は、透明ヒートシンク３２Ａ上に配線パターン４１を形成する工程と、透明ヒートシンク３２Ａの配線パターン４１側に半導体基板３５に対し上側に発光する複数の半導体発光素子３１（ＬＤ）を貼り合わせる工程と、複数の半導体発光素子３１を覆って樹脂３３により封止する工程と、透明ヒートシンク３２Ａをダイシングにより複数のパッケージに分割する工程とを有し、透明ヒートシンクをパッケージの窓部３２とすることを特徴とする。

【００１３】

【作用】第１の本発明に係る半導体発光素子のパッケージにおいては、半導体基板３５上側に発光する半導体発光素子３１と、透明ヒートシンクよりなるパッケージ窓部３２を有し、パッケージ窓部３２の配線パターン４１に対応して半導体発光素子３１を貼り合わせた構成とすることにより、パッケージ窓部３２を通して半導体発光素子３１の上側に光を出射させることができると同時に、パッケージ窓部３２がヒートシンクとして作用し、半導体発光素子３１の発熱を外部に放熱することができる。

【００１４】また、パッケージ窓部３２と半導体発光素子３１を貼り合わせて構成するので、パッケージ構造が極めて簡単化される。また、パッケージ窓部３２に配線パターン４１を形成するので、複雑な多層配線プロセスが簡易化され、且つこの半導体発光素子のパッケージを他の部品実装基板（例えば配線基板）４６に直接実装することが可能となり、半導体発光素子のパッケージの実装の取り扱いが簡便になる。

【００１５】第２の本発明に係る半導体発光素子のパッケージにおいては、更にパッケージ窓部に例えば光学素子等の要素部品５２，９６を形成することにより、多機能を持たせることが可能となる。

【００１６】第３の本発明に係る半導体発光素子のパッケージの製造方法においては、透明ヒートシンク３２Ａ上に配線パターンを形成し、この透明ヒートシンク３２Ａの配線パターン４１側に複数の半導体発光素子３１を貼り合わせた後、この複数の半導体発光素子３１を樹脂３３により封止するので、半導体発光素子３１は透明ヒートシンク３２Ａと樹脂３３により完全に気密封止される。次いで、透明ヒートシンク３２Ａを樹脂３３と共にダイシングし、複数のパッケージに分割し、透明ヒートシンクをパッケージ窓部３２とすることにより、発光素子３１の上側より光を取り出し、且つ上側のパッケージ窓部３２をヒートシンクとする目的の半導体発光素子のパッケージを簡単に製造することができ、大量生産に適する。

【００１７】

【実施例】以下、図面を参照して本発明による半導体発光素子のパッケージ及びその製造方法の実施例を説明する。

【００１８】図１Ａは本発明に係る半導体発光素子のパッケージの一実施例を示し、図１Ｂは、この半導体発光素子のパッケージを部品実装基板（例えば配線基板等）に取付けた状態を示す。本例においては、半導体発光素子３１と、この半導体発光素子３１から出力される光Ｌの波長に対して透明な（即ち透過率の高い）材料のヒートシンクよりなるパッケージ窓部３２と、半導体発光素子３１を封止する樹脂モールド体３３とより成る。

【００１９】半導体発光素子３１は、半導体基板３５の一面に水平共振器からなるレーザダイオードＬＤが形成され（但し、３６は活性層を代表として示す）、共振器端面３７Ａ，３７Ｂのうちの一方の共振器端面３７Ａに対向して例えば４５°の反射面３８が形成され、共振器端面３７Ａから出力された光Ｌが反射面３８で反射されて垂直方向に出射されるような面型発光素子として構成される。３９はレーザダイオードＬＤ及び反射鏡を含む領域を取り囲むように形成された分離溝であり、その分離溝の外周部４０が封止用領域となる。

【００２０】透明ヒートシンクよりなるパッケージ窓部３２は、レーザダイオードＬＤから出力される光波長に対して透明であると共に、外部からの光の入力も必要な素子の場合には、その入力波長光に対しても透明でなければならない。この透明ヒートシンクからなるパッケージ窓部３２の材料としては、例えばサファイヤ，ルビー，ベリリア，ダイアモンド，Ｓｉ，SiO_2 等を用いることができ、半導体発光素子の特性、ヒートシンクとして効果の大きさ、パッケージのコスト等を考慮した上で、最も適切な材料を選べばよい。

【００２１】パッケージ窓部３２は、樹脂モールド体３３よりも面積の大きい平行平面板からなり、その一方の面即ち半導体発光素子３１が実装される面３２ａに配線パターン４１を形成し、樹脂モールド体３３より外部に延長する部分に配線パターンに接続して信号取り出し用の電極パッド部４２を形成して構成される。配線パターン４１としては、Ａｌ，Ａｕ，あるいは透明配線材等通常の配線材料にて形成することができる。

【００２２】半導体発光素子３１は、その光Ｌの出射側の上面がパッケージ窓部３２の配線パターン４１に対接するようにパッケージ窓部３２に対してジャンクションダウンにより半田層４３〔４３Ａ，４３Ｂ〕を介して貼り合わされ、接合される。４３Ａは配線用半田であり、４３Ｂは素子３１の封止用領域に設けられた封止用半田である。

【００２３】この半導体発光素子３１が透明ヒートシンクよりなるパッケージ窓部３２に実装された状態で、半導体発光素子３１を覆うように裏面側から樹脂でモール

ドし、樹脂モールド体３３が形成される。

【００２４】半導体発光素子３１は、パッケージ窓部３２と樹脂モールド体３３によって全体が気密封止され、外部から保護される。

【００２５】かかる構成の半導体発光素子パッケージ１５は、図１Ｂに示すように、回路配線パターン等を有する部品実装基板４６に、電極パッド４２を介して実装される。この半導体発光素子パッケージ４５によれば、面型発光素子である半導体発光素子３１の光を出する表側に透明ヒートシンクよりなるパッケージ窓部３２を貼り合わせた構成であるので、半導体発光素子３１からの光を垂直方向に出射させることができると共に、このパッケージ窓部３２に直接接触していることによって、放熱を良好に行なうことができる。

【００２６】配線パターン４２をパッケージ窓部３２の一面に形成することにより、配線を半導体発光素子３１が形成される半導体チップ上とパッケージ窓部３２上に分けて形成できるので、複雑な多層配線プロセスの簡易化が図れる。

【００２７】さらに、従来のパッケージ構造に比べて、構造が非常に簡単となり、製造が簡単で且つ安価であり、大量生産に適する。

【００２８】図２は４５度反射型の面発光レーザＬＤを３×４個配列した面発光レーザアレイ４８を示す。この面発光レーザアレイ４８では、レーザアレイ側に下部配線層４９を形成し、透明ヒートシンクよりなるパッケージ窓部３２上に他の配線層（即ち配線パターン）４１を形成して構成される。下部配線層４９は、例えば半絶縁性ＧａＡｓ基板上に形成した例えばｎ型ＧａＡｓ層によって構成することができ、このｎ型ＧａＡｓ層上にレーザダイオードアレイが形成される。このように、面発光レーザアレイ４８に本発明を適用した場合、複雑な多層配線プロセスの簡易化が図れる。

【００２９】本発明は、図１の実施例にとらわれず、さまざまな変形が可能である。例えば樹脂モールド体に代えて半導体発光素子を接着剤等で固定してもよく、また、ＣＶＤで全面デポジットしてもよい。

【００３０】さらに、必要に応じて、このヒートシンクを兼ねるパッケージ窓部３２上には配線パターン４１だけでなく、ホログラム，グレーティング，レンズ，反射膜，非晶質シリコンや多結晶シリコンによるフォトディテクタ等の光学素子、さらに素子回路等の要素部品を集積することが可能である。次に変形例を示す。

【００３１】図３は、本発明に係る半導体発光素子のパッケージの他の実施例を示す。本例は、図１の構成において、樹脂モールド体３３に代えて、半導体発光素子３１と透明ヒートシンクよりなるパッケージ窓部３２とをその半導体発光素子３１の周辺を囲うように樹脂接着剤４８にて固定して構成される。その他の構成は、図１と同様であるので、対応する部分には同一符号を付して重複説明を省略する。

【００３２】図３の半導体発光素子パッケージ４９では、半導体発光素子３１が樹脂接着剤４８によりパッケージ窓部３２に固定されるので、より構造が簡単になり、製造を容易にすることができる。

【００３３】その他、図１の実施例と同様に、面型発光素子である半導体発光素子３１の光を出す表側に透明ヒートシンクよりなるパッケージ窓部３２を貼り合わせた構成であるので、半導体発光素子３１に対する良好なヒートシンク効果が得られる。また、複雑な多層配線プロセスの簡易化が図られること、大量生産に適すること等の効果が得られる。

【００３４】図４は、本発明に係る半導体発光素子のパッケージの他の実施例を示す。本例では、半導体発光素子として本出願人が先に提案した発光素子である半導体レーザＬＤと受光素子であるフォトダイオードＰＤを有してなる新規な光結合素子５１、すなわちＣＬＣ（コンフォーカルレーザカプラ）デバイスを適用した場合である。

【００３５】先ず、図１７～図１９を用いてＣＬＣデバイスの光結合素子５１について説明する。同図において、５１は光結合素子、６２は被照射部、６３は収束手段即ち集光光学レンズを示す。

【００３６】光結合素子５１は、発光部６４と受光部６５とが共通の半導体基板６６上に一体化されて成り、発光部６４からの出射光L_fが、被照射部６２に集束照射し、この被照射部６２から反射された戻り光L_Rが集束手段６３によって集光され、集束手段６３の共焦点位置（厳密には共焦点位置近傍）に配置された受光部６５に受光されるように構成される。この構成では発光部６４からの光が、被照射部６２において反射される前及び後において、その光軸を鎖線ａで示すように、互いに同軸の経路を通過して受光部６５において受光される構成とする。

【００３７】この光結合素子５１では、図１９の拡大図で示すように、発光部６４が水平共振器を有する半導体レーザＬＤ（但し６９はそのストライプ電極）、反射鏡６７で構成され、受光部６５がフォトダイオード（ＰＤ）で構成される。半導体レーザＬＤは、これからの出射光L_fを反射鏡６７によって反射させて被照射部６２に向かう経路に一致させている。

【００３８】そして、受光部６５に向かう戻り光L_Rは、光回折限界（即ちレンズの回折限界）近傍まで集束させるものであり、受光部６５はその少なくとも一部の受光面が、この光回折限界内、すなわち発光部６４からの出射光の波長をλ、収束手段６３の開口数をＮＡとするとき、受光面の配置基準面Ｓを横切る発光部６４からの出射光の光軸ａからの距離が$1.22\lambda/NA$以内の位置に設けられるようにする。

【００３９】また、この場合、図１８及び図２０に示す

ように、受光部６５の受光面の配置基準面Ｓでの発光部６４の出射光L_Fの直径ϕ_sを、上記光回折限界の直径ϕ_dより小とし、受光部６５の有効受光面は、発光の直径ϕ_s外に位置するようにする。ここで、受光部６４の光源として半導体レーザを用いると、その出射光の直径ϕ_sは、約１～２μｍ程度とすることができる。一方、収束手段６３の開口数ＮＡが光結合素子５１側を例えば０．０９～０．１、出射光の波長λが７８０ｎｍ程度の場合、回折限界すなわちϕ_dは１．２２λ／ＮＡ≒１０μｍ程度となる。

【００４０】そして、収束手段６３の１の焦点位置に発光部６４を配置し、共焦点位置に被照射部６２を配置する。発光部６４の半導体レーザＬＤから出射されたレーザ光は反射鏡６７で概略垂直方向へ反射され、収束手段６３を通して被照射部（例えば光ディスク）６２に照射される。合焦時に、被照射部６２から反射された戻り光、すなわち、被照射部６２における記録情報を含んで反射した戻り光L_Rは、同じ光路を逆戻りし、再び収束手段６３によって集光され、共焦点位置近傍に配置された受光部６５のフォトダイオードに入射し、この戻り光L_Rが受光部６５で受光検出されるようになる。即ち、電気信号に変換され信号（例えば再生信号）として取り出される。

【００４１】ここで図２１及び図２２を用いて光結合素子５１の製造方法の代表例を説明する。この例は選択的ＭＯＣＶＤによって製造する場合である。図２１Ａに示すように、第１導電型例えばｎ型の（１００）結晶面を主面とするＧａＡｓ基板よりなる基板６６上に、半導体レーザを構成する各半導体層をエピタキシャル成長する。すなわち、例えば順次基板６と同導電型のＡｌＧａＡｓよりなる第１のクラッド層７１、例えばＧａＡｓよりなる活性層７２、第１のクラッド層７１と異なる第２導電型例えばｐ型のＡｌＧａＡｓよりなる第２のクラッド層７３とを順次ＭＯＣＶＤ等によってエピタキシーした積層半導体層を構成する。

【００４２】次に、図２１Ｂに示すように、これらエピタキシャル成長した半導体層７３，７２，７１の一部を半導体レーザＬＤとして残して少なくとも最終的に反射鏡を形成する部分をＲＩＥ（反応性イオンエッチング）等によってエッチングする。そして、このエッチング面による半導体層の両端面を夫々共振器端面５５Ａ及び５５Ｂとし、両端面５５Ａ及び５５Ｂ間に半導体レーザＬＤの水平共振器を構成する。この場合、図示しないが、最終的に半導体レーザＬＤの共振器を構成する領域を挟むように電流阻止領域を不純物のイオン注入によって形成する。

【００４３】次いで、図２１Ｃに示すように、基板６６上に残された積層半導体層、即ち半導体レーザＬＤの構成部を覆うように、選択的ＭＯＣＶＤのマスク層７４例えばSiO_2、ＳｉＮ等の絶縁層を被着形成する。

【００４４】次に、図２２Ｄに示すように、マスク層７４によって覆われていない基板６６上に例えば第１導電型例えばｎ型のＧａＡｓによる第１の半導体層７５を選択的にＭＯＣＶＤによって形成する。

【００４５】続いて、図２２Ｅに示すように、第２導電型例えばｐ型のＧａＡｓによる第２の半導体層７６を選択的にＭＯＣＶＤによって形成し、第１および第２の半導体層７５および７６によってフォトダイオードＰＤを形成する。

【００４６】次に、図２２Ｆに示すように、マスク層７４をエッチング除去し、半導体レーザＬＤ上と、第２半導体層７６上の一部とに、半導体レーザＬＤとフォトダイオードＰＤの各一方の電極７７および７８を夫々オーミックに被着し、基板６６の裏面に共通の電極７９をオーミックに被着する。

【００４７】この場合、図２２Ｄの基板６６上に選択的にエピタキシャル成長された半導体層、この例では第１半導体層７５の、共振器端面５５Ａと対向する面８０が特定された結晶面となる。例えば、半導体レーザの端面５５Ａ及び５５Ｂ間に形成された半導体レーザの水平共振器の共振器長方向、即ち図２２Ｆ中、矢印ｂで示す方向を〔０１１〕結晶軸方向とするときは対向面８０は｛１１１｝Ａによる斜面として生じ、方向ｂを〔０－１１〕結晶軸方向とするときは｛１１１｝Ｂによる斜面として生じ、いずれも基板６６の板面とのなす角が５４．７°となる。また、方向ｂを〔１００〕結晶軸方向とするときは対向面８０は｛１１０｝として生じ、基板６６の面に対し、４５°をなす。いずれも原子面によるモフォロジーの良い斜面８０として形成される。

【００４８】したがって、このようにして形成された特定された結晶面による斜面８０を、図２２Ｆに示すように、半導体レーザＬＤの水平共振器の端面５５Ａからの出射光L_1を反射させて所定方向に向ける反射鏡６７とすることができる。この構成によれば、反射鏡６７が、結晶面によって形成されることから鏡面性にすぐれ、またその傾きの設定が正確に行われる。

【００４９】しかして、本例においては、図４Ａに示すように、上述した半導体発光素子としての光結合素子５１と、この光結合素子５１の半導体レーザＬＤから出力される光（及び戻り光）Ｌの波長に対して透明な材料のヒートシンクよりなるパッケージ窓部３２と、光結合素子５１を封止する樹脂モールド体３３とより成る。パッケージ窓部３２を構成する材料は、前述の図１と同様の材料を用い得る。

【００５０】本例では、特にパッケージ窓部３２の光結合素子５１の実装面に所定の電極パターン４１を形成し、その電極パッド４２を実装面とは反対面、即ちパッケージ窓部３２の表側面に臨むように形成すると共に、このパッケージ窓部３２にホログラムやグレーティング等の光学素子、本例ではホログラム５２を作り込む。

【００５１】そして、この光結合素子５１、即ちその水平共振器の半導体レーザＬＤ側の面をパッケージ窓部３２の配線パターン４１に対接するように半田層４３〔４３Ａ，４３Ｂ〕を介して所謂ジャンクションダウンによりパッケージ窓部３２に貼り合わせて固定し、光結合素子５１の裏面側から樹脂モールド体３３を形成して半導体発光素子パッケージ５４が構成される。ホログラム５２は半導体レーザＬＤからの光がパッケージ窓部３２を透過する位置に対応するように設けられる。

【００５２】受光部としては、例えばホログラム５２を通過した戻り光のうちの０次光の到達する共焦点位置と、例えば＋１次光及び－１次光が到達する夫々の位置に設けられる。この半導体発光素子パッケージ５４は、図４Ｂに示すように、部品実装基板４６に対してパッケージ窓部３２の表側が下向きとなるように電極パッド４２を介して実装される。

【００５３】かかる構成の半導体発光素子パッケージ５４において、ヒートシンクを兼ねるパッケージ窓部３２にホログラム５２やグレーティング等の光学素子を作り込むことで、さらに多くの機能を持たせることができる。その他、図１の実施例で説明したと同様の作用効果を奏する。

【００５４】次に、図５及び図６を用いて、上記半導体光学素子パッケージ５４の製造方法の一例を説明する。

【００５５】先ず、図５Ａに示すように、ヒートシンク兼用のパッケージ窓部３２となる透明基板３２Ａを用意し、各々のパッケージ窓部となる領域部毎に電極パッドを形成するためのスルーホール５７を形成する。

【００５６】次に、図５Ｂに示すように、透明基板３２Ａの各領域部に対応する一面３２ａ上に夫々所定の配線パターン４１を形成し、またこの配線パターン４１に接続するようにスルーホール５７を通して透明基板３２Ａの他面３２ｂ側に臨むように電極パッド４２を形成する。更に、配線パターン４１上に半田層４３〔４３Ａ，４３Ｂ〕を形成する。

【００５７】次に、図５Ｃに示すように、透明基板３２Ａの他面３２ｂの所定位置にホログラム５２を形成する。

【００５８】次に、図６Ｄに示すように、光結合素子５１をジャンクションダウンにより透明基板３２Ａの配線パターン４１側に貼り合わせて固定する。光結合素子５１は配線パターン４１にジャンクションダウンで接合される。光学素子５１の基板側は例えばワイヤーボンディングで他の配線パターン４１に接続することもできる。

【００５９】次に、図６Ｅに示すように、各光結合素子５１を覆うように全面樹脂モールドし、樹脂モールド体３３を形成する。

【００６０】しかる後、図６Ｆに示すように、ダイシング加工を施して複数のパッケージに分割し、光結合素子５１をホログラム５２が形成された透明ヒートシンクのパッケージ窓部３２に貼り合わせ、樹脂モールド体にて光結合素子５１を覆ってなる目的の半導体発光素子パッケージ５４を得る。

【００６１】かかる製造方法によれば、製造工程が極めて簡潔化され、半導体発光素子パッケージ５４は構造が簡単で且つ極めて小型化される。従って、大量生産に向いており、製造コストの低減化及び製品の小型化等に有利となる。

【００６２】図７及び図８は、リードフレームを利用した製造方法の他の例を示す。図７Ａに示すように、ヒートシンク兼用のパッケージ窓部３２となる透明基板３２Ａを用意し、各々のパッケージ窓部となる領域部の一面３２ａ上に夫々所定の配線パターン４１及び電極パッド４２を形成し、配線パターン４１上に半田層４３〔４３Ａ，４３Ｂ〕を形成する。

【００６３】次に図７Ｂに示すように、透明基板３２Ａの各領域部の他面３２ｂの所定位置にホログラム５２を形成する。

【００６４】次に、図７Ｃに示すように、光結合素子５１をジャンクションダウンにより透明基板３２Ａの配線パターン４１側に貼り合わせて固定する。

【００６５】次に、図８Ｄに示すように、各光結合素子５１が分離されるように透明基板３２Ａをダイシングにより分割する。

【００６６】然る後、各光結合素子５１が固定された状態のパッケージ窓部３２をその電極パッド４２を介してリードフレーム５８に接合し、次いで樹脂モールドを施して樹脂モールド体３３を形成する。このようにして、リードを導出した型式の目的とする半導体発光素子パッケージ５９を得る。

【００６７】この製造方法によれば、リード部を必要とした実装に適した半導体発光素子パッケージ５９が容易に製造できる。

【００６８】図９は、本発明に係る半導体発光素子のパッケージの他の実施例を示す。

【００６９】本例は、パッケージ窓部として熱伝導率があまり高くない透明材料、例えばプラスチック等の材料によるパッケージ窓部９２を用いる。このパッケージ窓部９２の一面にメッキ等を利用して配線パターンを兼ねる金属厚膜ヒートシンク９３を形成する。この例では厚膜ヒートシンク９３に接続する電極パッド４２をパッケージ窓部９２の表面に臨むように形成される。そして、この厚膜ヒートシンクの配線パターン９３に半田層４３〔４３Ａ，４３Ｂ〕を介して光結合素子５１を貼り合わせ、樹脂モールド体３３を形成して半導体発光素子パッケージ９４を構成する。

【００７０】かかる構成の半導体発光素子パッケージ９４によれば、平板状のパッケージ窓部９２に厚膜ヒートシンクを兼ねる配線パターン９３を形成するので、図２４に示す例のように凹凸のある発光素子に直接形成する

よりも容易に構成できる。また、パッケージ窓部９２として、熱伝導率の高くない透明材料（例えばプラスチック等）を利用できるので、コスト的に有利な半導体発光素子パッケージを構成することができる。

【００７１】図１０は、本発明に係る半導体発光素子のパッケージの他の実施例を示す。本例の半導体発光素子パッケージ９７は、透明ヒートシンクからなるパッケージ窓部３２と、光結合素子５１と樹脂モールド体３３とからなり、パッケージ窓部３２の両面に光学素子、即ちホログラム５２とグレーティング９６を作り込んで構成する。用途に応じてパッケージ窓部３２に通常のレンズ，フレネルレンズ，プリズム等を作り込んで多機能化することもできる。その他の構成は図４と同様であるので、対応する部分に同一符号を付して重複説明を省略する。

【００７２】図１１は、本発明に係る半導体発光素子のパッケージの他の実施例を示す。本例の半導体発光素子パッケージ９９は、透明ヒートシンクよりなるパッケージ窓部３２には光学素子を作り込まず、図１０に示すように、別の透明板１０１の両面に光学素子、例えばホログラム５２及びグレーティング９６を形成し、この透明板１０１をパッケージ窓部３２の光結合素子５１が貼り合わされた面とは反対の表面に貼り合わせて構成する。その他の構成は、図１Ａと同様であるので、対応する部分には同一符号を付して重複説明を省略する。

【００７３】かかる構成の半導体発光素子パッケージ９９によれば、別の透明板１０１の追加で部品点数は増えるものの、光学素子のホログラム５２及びグレーティング９６の位置合わせが、発光素子や受光素子の実装後、即ち本例では光結合素子５１のパッケージ窓部３２への実装後に行えるので、高い精度の位置合わせを必要とするものには都合がよく、歩留り等に有利となる。また、別の透明板１０１には、用途に応じて、通常のレンズ，フレネルレンズ，プリズム等を作り込んで多機能化するとこが可能となる。

【００７４】図１２は、本発明に係る半導体発光素子のパッケージの他の実施例を示す。本例の半導体発光素子パッケージ１０３は、ＣＬＣデバイスである光結合素子５１の受光素子即ちフォトダイオードＰＤをレーザ側でなく、パッケージ窓部３２側に作り込むようにする。

【００７５】即ち、透明ヒートシンクからなるパッケージ窓部３２の一面に例えばプラズマＣＶＤによるアモルファスシリコンや多結晶シリコンによるフォトダイオードＰＤを半導体レーザＬＤ及び反射面６７に対応する位置に形成し、フォトダイオードＰＤの配線１０４を形成する。１０５はフォトダイオードＰＤを保護するための絶縁膜である。この絶縁膜１０５を含んでチップ用の所要の配線パターン４１を形成する。パッケージ窓部３２の他面には光学素子例えばホログラム５２を形成する。そして、光結合素子５１を、半田層４３〔４３Ａ，４３Ｂ〕を介して配線パターン４１に接続するようにパッケージ窓部３２に貼り合わせ、光結合素子５１の裏面より樹脂モールド体３３を形成して半導体発光素子パッケージ１０３を構成する。

【００７６】光結合素子５１において、受光素子であるフォトダイオードＰＤをレーザ側に作り込む際、反射面６７上には作り易いがレーザＬＤ上にはレーザＬＤとフォトダイオードＰＤの電極を独立に取るのが難しく、作り難い。しかし、図１１の半導体発光素子パッケージ１０３によれば、パッケージ窓部３２上にフォトダイオードＰＤを形成するので、上記問題が解決でき、受光効率を上げることができる。

【００７７】図１３は、本発明に係る半導体発光素子のパッケージの他の実施例を示す。本例の半導体発光素子パッケージ１０７は、図１２の半導体発光素子パッケージ１０３において、光結合素子５１の反射面６７の角度αを４５°より大きい角度とし、出射光L_fの一部をパッケージ窓部３２の表面で反射してパッケージ窓部３２に形成したフォトダイオードＰＤ〔PD_a，PD_b，PD_c〕のレーザＬＤ側のフォトダイオードPD_c（例えばレーザ出力モニタ用）に受光させ、戻り光L_rをパッケージ窓部３２内で反射させて反射面６７側のフォーカスサーボ信号検出用又はトラックサーボ信号検出用のフォトダイオードPD_a，PD_bに受光するように構成する。図１３は要部のみを示しているが、その他の構成は、図１２と同様であるので省略する。

【００７８】なお、この例ではパッケージ窓部３２内を反射させた構成としたが、その他パッケージ窓部３２上に別の透明板を配置し、この透明板を反射用に利用することもできる。

【００７９】図１４は、本発明に係る半導体発光素子のパッケージの他の実施例を示す。本例の半導体発光素子パッケージ１０９は、透明ヒートシンクからなるパッケージ窓部３２上にハイブリッドでＣＬＣデバイスの光結合素子５１と演算用ＩＣ１１０を集積し、背面より全面モールドして樹脂モールド体３３を形成して構成する。その他、図４と対応する部分には同一符号を付して重複説明を省略する。

【００８０】この構成では背面を樹脂モールド体３３で全面を覆ってしまうので、演算用ＩＣ１１０を光学的に完全に閉じ込めることができ、光結合素子５１からの迷光による誤動作等の問題もない。

【００８１】上述した、各半導体発光素子パッケージ９４，９７，９９，１０３，１０７，１０９においても、図１の実施例で説明したと同様の作用効果を奏する。ＣＬＣデバイスの光結合素子５１を用いた半導体発光素子パッケージの各実施例は、いわゆるコンパクトディスク（ＣＤ）プレーヤー、光磁気ディスクプレーヤー等の光ディスクドライブの光ピックアップに適用できる。

【００８２】一方、本発明は、垂直共振器面発光レーザ

への応用にも有利である。

【００８３】図１５は、垂直共振器面発光レーザに適用した本発明に係る半導体発光素子のパッケージの他の実施例を示す。本例においては、例えばｎ型基板１１２上に高反射の半導体多層膜や誘電体多層膜からなる第１の反射膜（ｎ型）１１３が形成され、この反射膜１１３上に第１のクラッド層１１４、活性層１１５、第２のクラッド層１１６及び第１の反射膜１１３と同様の第２の反射膜（ｐ型）１１７を形成すると共に、両側に電流ブロック層１１８を形成し、さらにキャップ層１１９を形成して電流注入Ａにより垂直方向に面発生する垂直共振器面発光レーザ１２０の出射面側を、透明ヒートシンクよりなるパッケージ窓部３２にその配線パターン４１が形成された面に半田層４３を介して貼り合わせ、背面を樹脂モールド体３３にて被覆して半導体発光素子パッケージ１２１を構成する。

【００８４】この構成においても、パッケージ窓部３２を透過して光が出射すると共に、このパッケージ窓部３２がヒートシンクとなって面発光レーザの放熱を良好にする。

【００８５】一般に、垂直共振器面発光レーザは、高反射の半導体多層膜や誘電体多層膜があるため、電流注入Ａがしにくく、素子間抵抗が高くなる。そのため発熱が大きく、素子の効率や性能に大きな影響を与える。

【００８６】図１６は、垂直共振器面発光レーザに適用した本発明に係る半導体発光素子のパッケージの更に他の実施例を示す。本例の半導体発光素子パッケージ１２２は、光を出射するフロント側の第２の反射膜１１７をパッケージ窓部３２側に形成して構成する。その他の構成は、図１５と同じであり、対応する部分には同一符号を付して重複説明を省略する。

【００８７】この構成では、マイクロキャビティ構造は作り難くなるが、比較的共振器の長めのレーザであれば例えばｐ側の反射膜として利用することで、電流注入の問題をかなり低減できる。

【００８８】図１２及び図１７を用いて半導体発光素子パッケージ１０３の実際のプロセス及び構造をより詳細に説明する。ＣＬＣデバイスである光結合素子５１は、図１７Ａ（断面図）及び図１７Ｂ（平面図）で示すように、半導体基板上の中央にストライプ電極１３２が形成された水平共振器の半導体レーザＬＤが形成され、その一方の共振器端面５５Ａに対向して反射面６７が形成される。他方の共振器端面５５Ｂに対向する領域には分離溝３９を介してモニター用のフォトダイオードPD_1が形成される。反射面６７側の領域上には、トラッキングサーボ用のフォトダイオードPD_3と、之を挟む両側にメタルグリッド付きのフォーカスサーボ用のフォトダイオードPD_4，PD_5が形成され、各フォトダイオードPD_2，PD_3，PD_4，PD_5からコンタクト用の電極部１３０が形成される。基板６６上の外周囲にはシール用のメタル層１３１が形成される。

【００８９】パッケージ１０３の外部電極（即ち電極パッド）はスルーホールを用いた型式や、片面のみの型式を用途によって使い分けが可能である。外部電極（即ち電極パッド）と内部配線（即ち配線パターン）は、例えばＡｌ等で形成され、表面をSiO_2又は／及びＳｉＮ等で保護されている。シール用メタル層１３１と、各フォトダイオードPD_2，PD_3，PD_4，PD_5のコンタクト用の電極部１３０に相当する部分は、半田４３又はＡｕ電極がパターニングされ、Ａｌ等の配線パターン４１と接続されている。

【００９０】光結合素子５１のパッケージ窓部３２への実装プロセスにおいては、半田のパターニングを用いる場合、図１１で下から光学的に顕微鏡モニタすることが容易であるため、非常に精密な位置精度出しが可能となる。

【００９１】光結合素子５１の実装は、個別プロセスであるが、一つのパッケージ窓部３２（即ち例えば直径３インチのサファイア基板）上に多数の光結合素子５１を実装し、半田熱工程を一括して行なうことができ、いわゆるバッチ・プロセスとなるため、工程数を減らすことができる。また、半田以外にもＡｕ層とＡｕ層の接着を超音波で行うことも可能である。

【００９２】双方の接続において、シール用メタル構造により、光結合素子５１は、全体がシール用メタル層と、半導体基板と、パッケージ窓部とで封止されることにより、耐温度、信頼性の面で非常に優れた素子となる。

【００９３】全面モールドは、光結合素子の耐環境性というよりも、ＧａＡｓ基板が露出することを防ぐ目的であって、従って幾つかの塗布手段がある。例えば、スピンコーティングしたエポキシ熱硬化タイプや紫外線（ＵＶ）硬化型樹脂等、きめの粗いディッププロセスでも十分である。

【００９４】ダイシングにおいては、シリコンにおけるいわゆるフルカットプロセスを行い、ウェハ厚み全体をダイサーで切り落とす。従って、このパッケージングされた光結合素子は、通常の半導体ペレットと同じ感覚でハンドリングすることが可能で、物流上も単純である。即ち、粘着シート上のチップ部品と同じように基板への自動実装が容易に可能となる。

【００９５】

【発明の効果】第１の本発明に係る半導体発光素子パッケージによれば、面型発光素子の表側に光を出しながら、表側に配したパッケージ窓部がヒートシンクとして作用し、面型発光素子の発熱を有効に放熱させることができる。

【００９６】パッケージ窓部に配線パターンを形成しているので、配線をチップ上とヒートシンクのパッケージ窓部上に分けて形成することができ、複雑な多層配線プ

ロセスの簡易化を図ることができる。

【００９７】更にパッケージ構造が従来に比べて簡素化されるので、製造が容易となり、且つ安価に提供できる。

【００９８】第２の本発明に係る半導体発光素子パッケージによれば、パッケージ窓部にホログラム，グレーティング，レンズ，反射膜，フォトディテクタ，電子回路等の要素部品を形成するので、パッケージとして更に多機能化を図ることができる。

【００９９】第３の本発明に係る半導体発光素子パッケージの製造方法によれば、半導体発光素子の表側に光を出しながら且つ表側にヒートシンクを必要とする面型発光素子のパッケージを簡単且つ精度よく製造することができる。

【図面の簡単な説明】

【図１】Ａ　本発明に係る半導体発光素子パッケージの一実施例を示す断面図である。

Ｂ　本発明に係る半導体発光素子パッケージを部品実装基板に実装した状態を示す断面図である。

【図２】面発光レーザアレイに適用した本発明に係る半導体発光素子パッケージの他の実施例を示す要部の斜視図である。

【図３】Ａ　本発明に係る半導体発光素子パッケージの他の実施例を示す断面図である。

Ｂ　本発明に係る半導体発光素子パッケージを部品実装基板に実装した状態を示す断面図である。

【図４】Ａ　本発明に係る半導体発光素子パッケージの他の実施例を示す断面図である。

Ｂ　本発明に係る半導体発光素子パッケージを部品実装基板に実装した状態を示す断面図である。

【図５】Ａ　本発明に係る半導体発光素子パッケージの製造方法の一実施例を示す工程図である。

Ｂ　本発明に係る半導体発光素子パッケージの製造方法の一実施例を示す工程図である。

Ｃ　本発明に係る半導体発光素子パッケージの製造方法の一実施例を示す工程図である。

【図６】Ｄ　本発明に係る半導体発光素子パッケージの製造方法の一実施例を示す工程図である。

Ｅ　本発明に係る半導体発光素子パッケージの製造方法の一実施例を示す工程図である。

Ｆ　本発明に係る半導体発光素子パッケージの製造方法の一実施例を示す工程図である。

【図７】Ａ　本発明に係る半導体発光素子パッケージの製造方法の他の実施例を示す工程図である。

Ｂ　本発明に係る半導体発光素子パッケージの製造方法の他の実施例を示す工程図である。

Ｃ　本発明に係る半導体発光素子パッケージの製造方法の他の実施例を示す工程図である。

【図８】Ｄ　本発明に係る半導体発光素子パッケージの製造方法の他の実施例を示す工程図である。

Ｅ　本発明に係る半導体発光素子パッケージの製造方法の他の実施例を示す工程図である。

【図９】本発明に係る半導体発光素子パッケージの他の実施例を示す断面図である。

【図１０】本発明に係る半導体発光素子パッケージの他の実施例を示す断面図である。

【図１１】本発明に係る半導体発光素子パッケージの他の実施例を示す断面図である。

【図１２】本発明に係る半導体発光素子パッケージの他の実施例を示す断面図である。

【図１３】本発明に係る半導体発光素子パッケージの他の実施例を示す要部の断面図である。

【図１４】本発明に係る半導体発光素子パッケージの他の実施例を示す部品実装基板に実装した状態の断面図である。

【図１５】本発明を垂直共振器面発光素子に適用した場合の他の実施例を示す要部の断面図である。

【図１６】本発明を垂直共振器面発光素子に適用した場合の更に他の実施例を示す要部の断面図である。

【図１７】Ａ　ＣＬＣデバイスの光結合素子の具体例を示す断面図である。

Ｂ　ＣＬＣデバイスの光結合素子の具体例を示す平面図である。

【図１８】本発明に係る光結合素子の説明に供する構成図である。

【図１９】図１８の光結合素子の要部の拡大斜視図である。

【図２０】光結合素子の説明図である。

【図２１】Ａ　光結合素子の代表的な製造方法の製造工程図である。

Ｂ　光結合素子の代表的な製造方法の製造工程図である。

Ｃ　光結合素子の代表的な製造方法の製造工程図である。

【図２２】Ｄ　光結合素子の代表的な製造方法の製造工程図である。

Ｅ　光結合素子の代表的な製造方法の製造工程図である。

Ｆ　光結合素子の代表的な製造方法の製造工程図である。

【図２３】本発明の説明に供する面型半導体発光素子の断面図である。

【図２４】本発明の説明に供する面型半導体発光素子の断面図である。

【図２５】従来の半導体発光素子パッケージの一例を示す断面図である。

【図２６】従来の半導体発光素子パッケージの他例を示す断面図である。

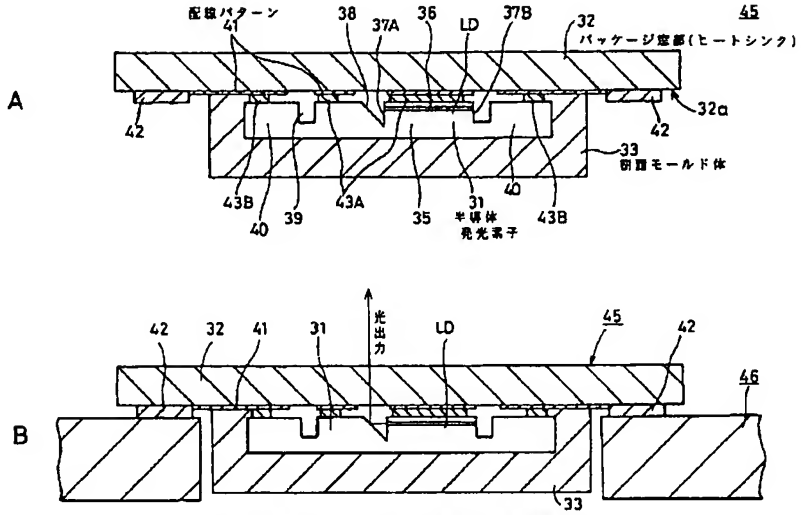
【符号の説明】

３１　半導体発光素子

17　　18

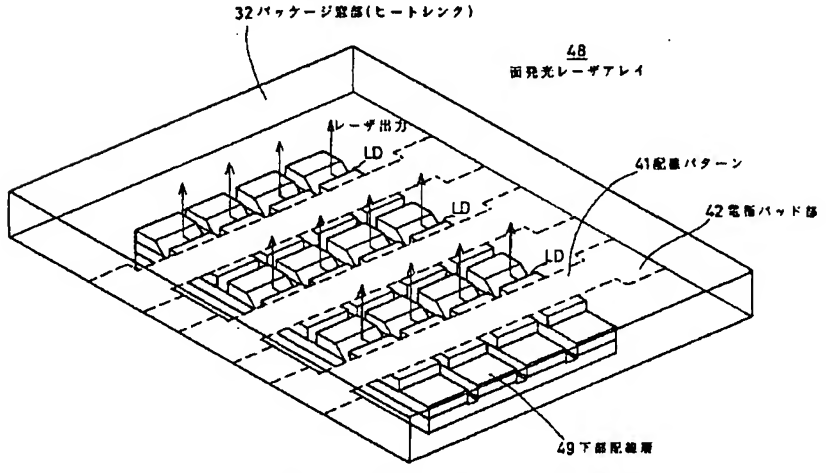
３２　透明ヒートシンクよりなるパッケージ窓部
３３　樹脂モールド体
３５　半導体基板
ＬＤ　レーザダイオード
ＰＤ　フォトダイオード
４１　配線パターン
＊４２　電極パッド
４３〔４３Ａ，４３Ｂ〕　半田層
５１　光結合素子
５２　ホログラム
９６　グレーティング
＊

【図１】



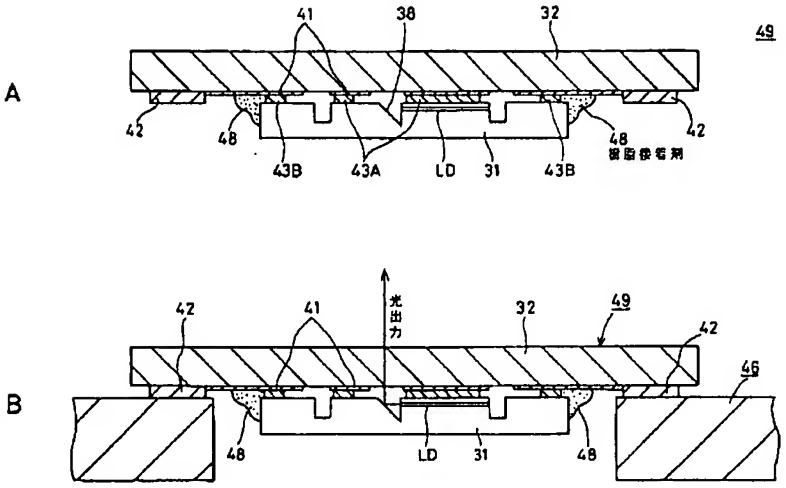
第１実施例及び実装状態の断面図

【図２】



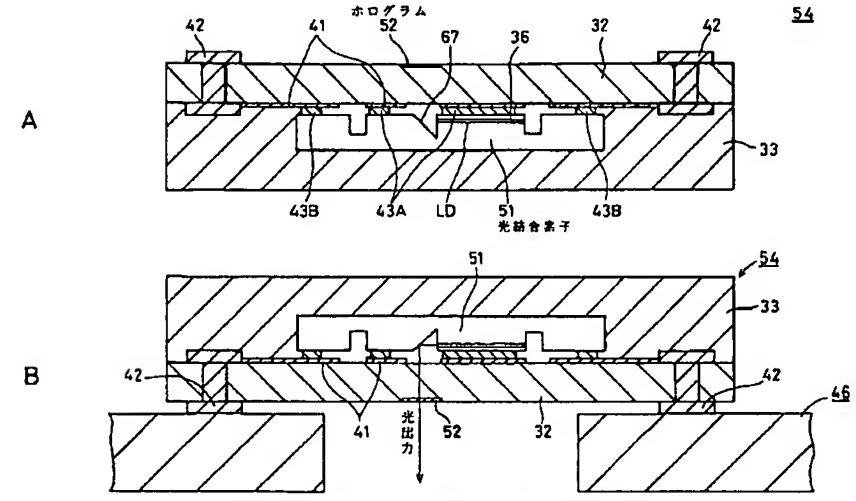
第２実施例の要部の斜視図

【図3】



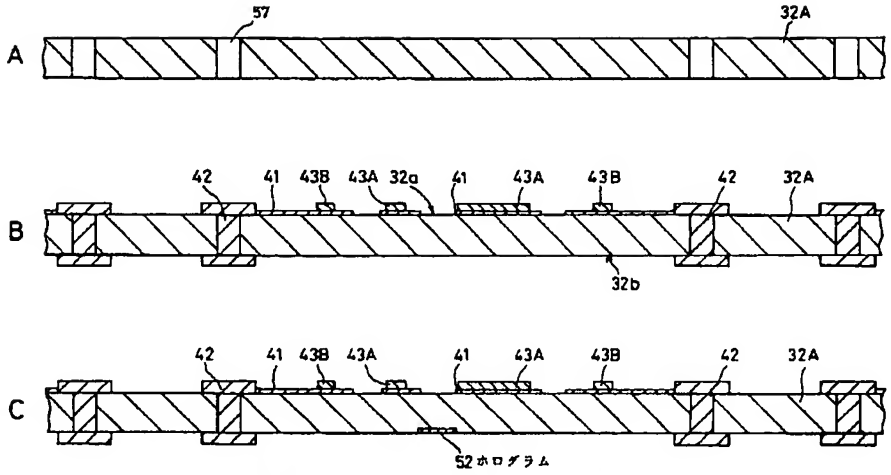
第3実施例及び実装状態の断面図

【図4】



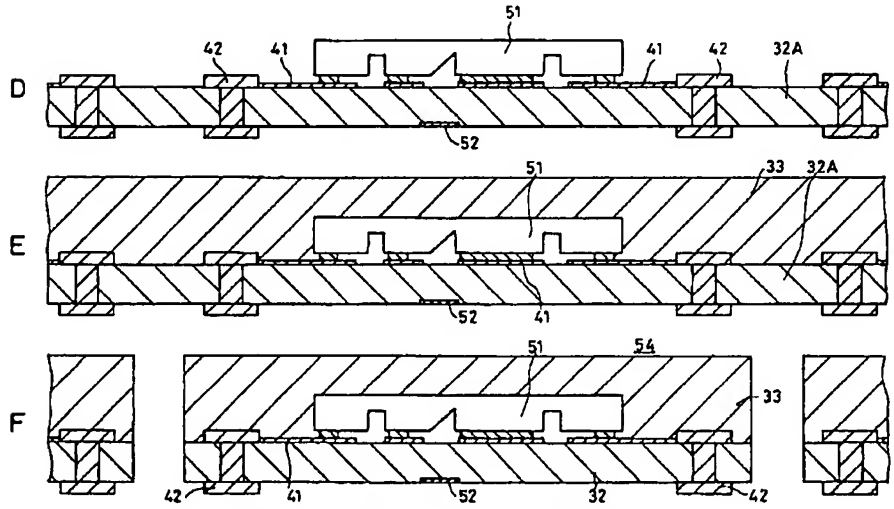
第4実施例及び実装状態の断面図

【図5】



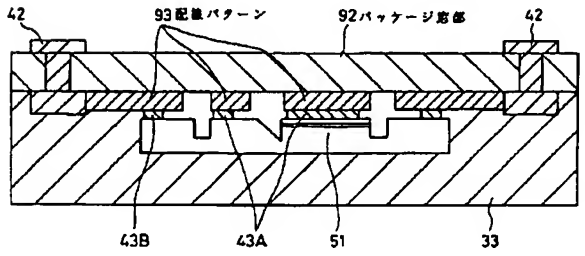
製造方法の第１実施例の工程図（その１）

【図6】



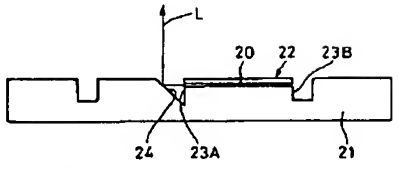
製造方法の第１実施例の工程図（その２）

【図9】



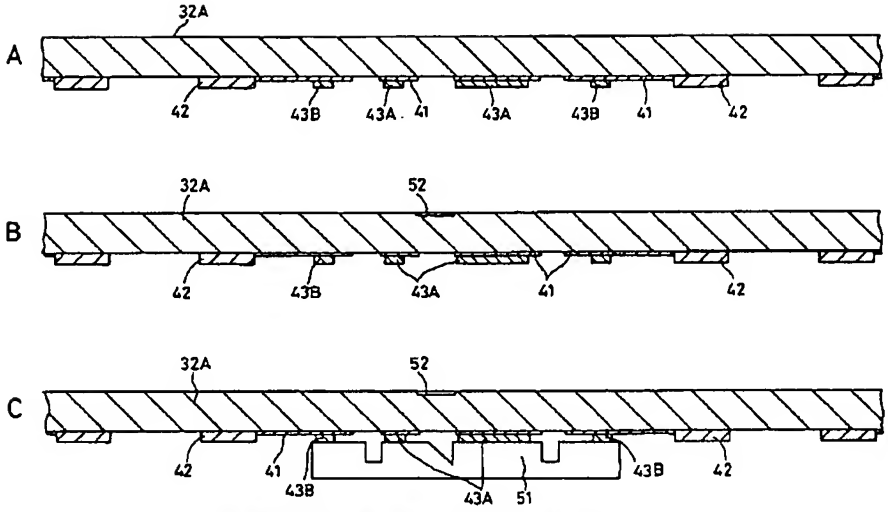
第５実施例の断面図

【図２３】



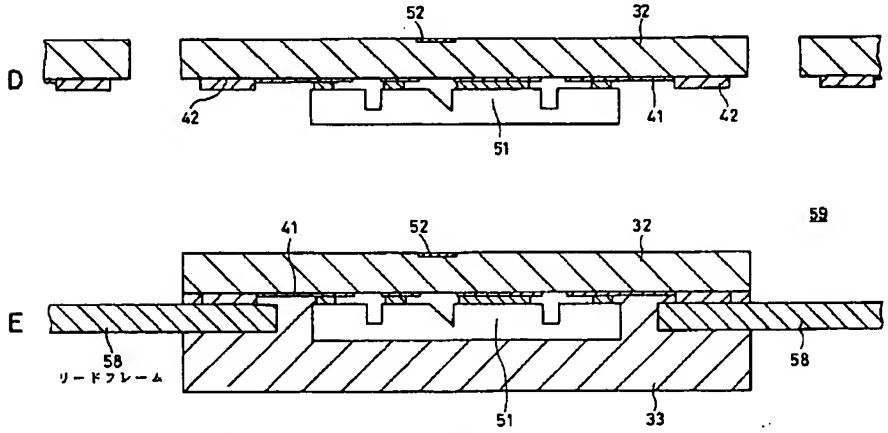
本発明の説明に供する
面型半導体発光素子の断面図

【図7】



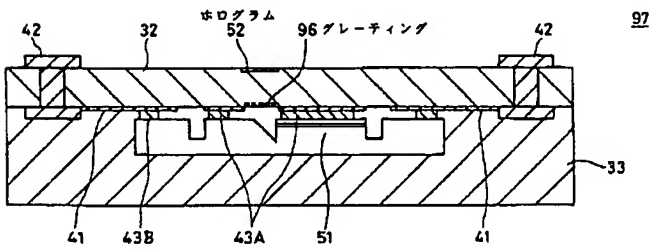
製造方法の第２実施例の工程図（その１）

【図8】



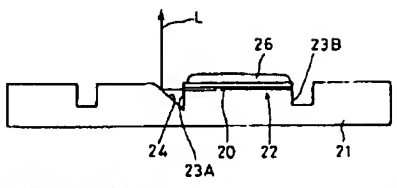
製造方法の第２実施例の工程図（その２）

【図10】



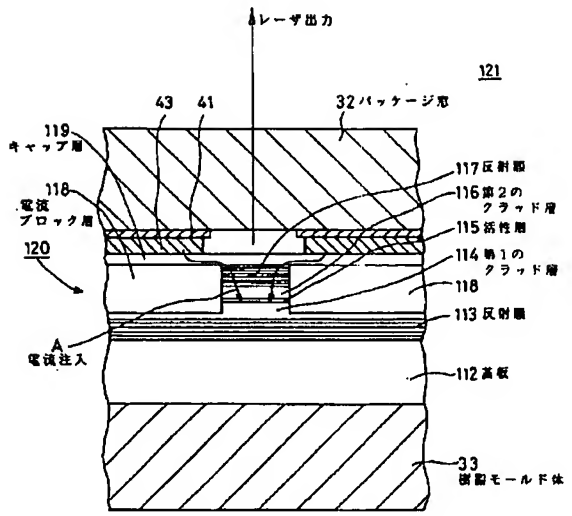
第６実施例の断面図

【図24】



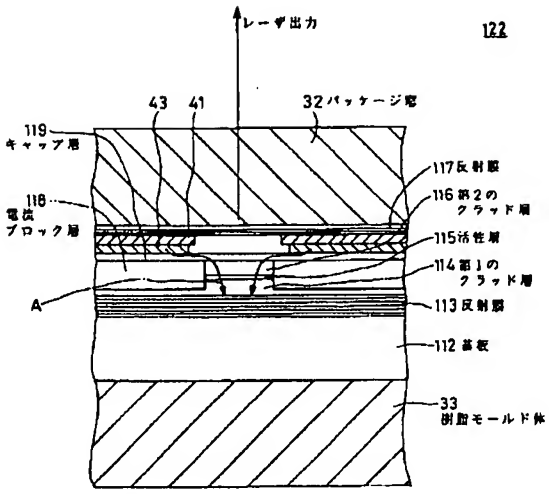
本発明の説明に供する
面型半導体発光素子の断面図

【図１５】



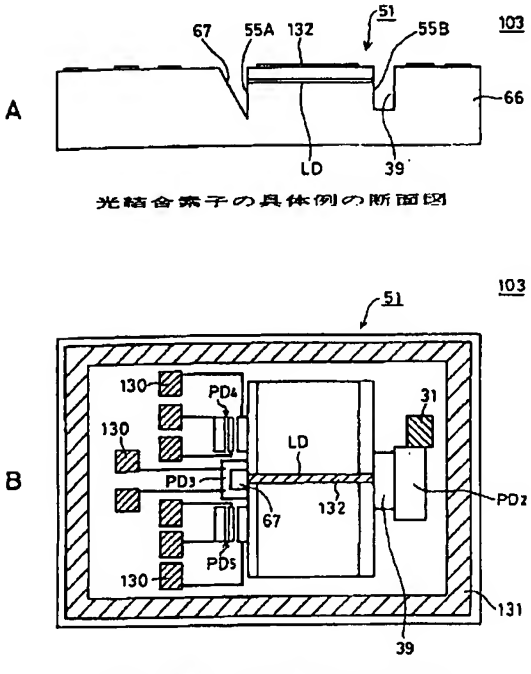
第１１実施例に係る
垂直共振器面発光素子の要部の断面図

【図１６】



第１２実施例に係る
垂直共振器面発光素子の要部の断面図

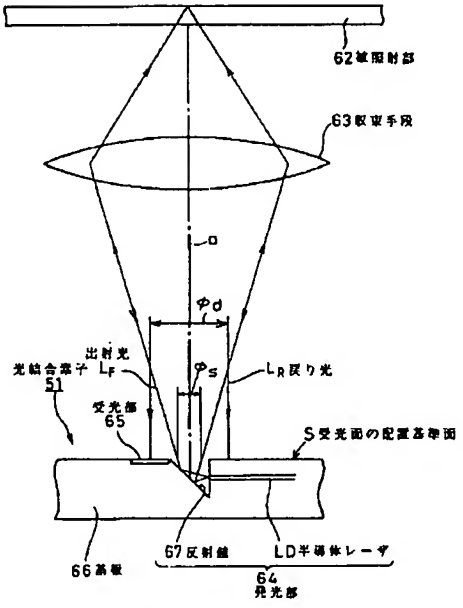
【図１７】



光結合素子の具体例の断面図

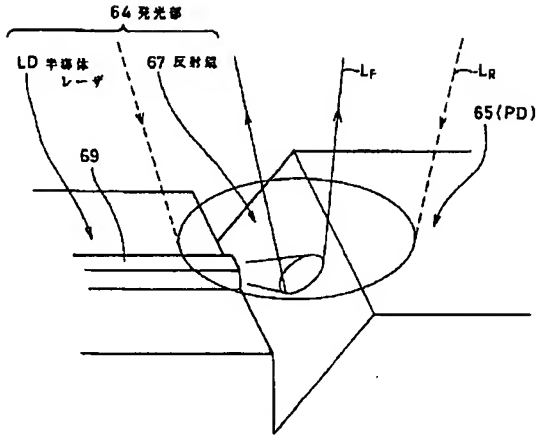
光結合素子の具体例の平面図

【図１８】



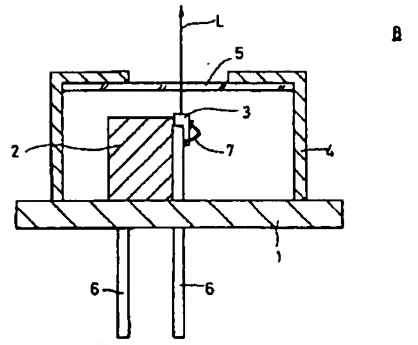
光結合素子の構成図

【図19】



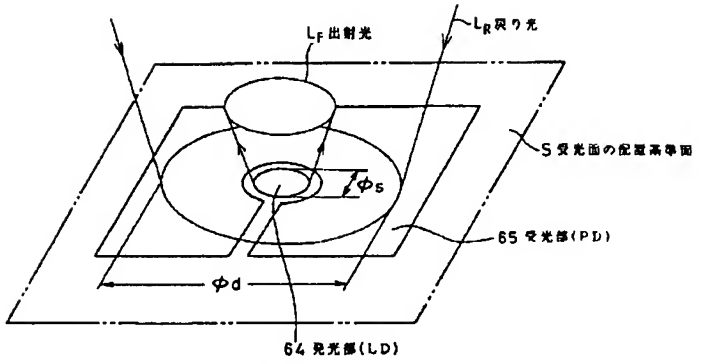
要部の拡大斜視図

【図25】



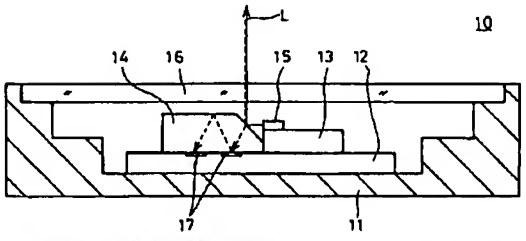
従来の半導体発光素子
パッケージの一例の断面図

【図20】



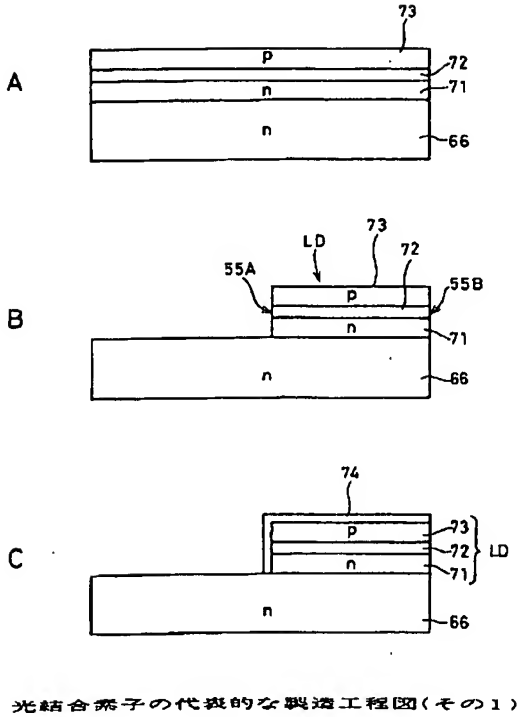
光結合素子の説明図

【図26】



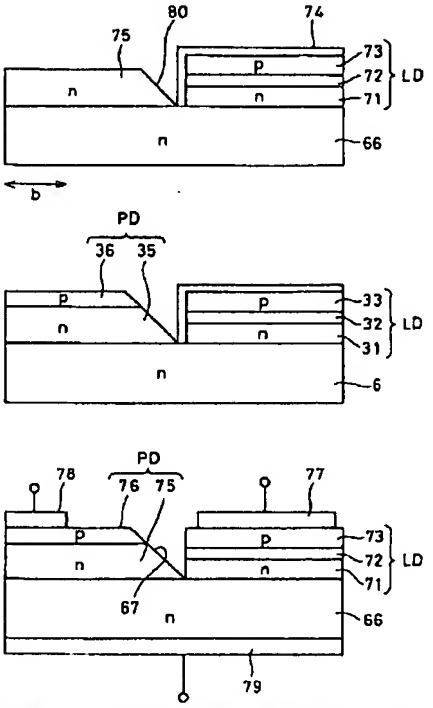
従来の半導体発光素子
パッケージの他例の断面図

【図２１】



光結合素子の代表的な製造工程図（その１）

【図２２】



光結合素子の代表的な製造工程図（その２）

フロントページの続き

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